1999 Beneficial Use Reconnaissance Project

Workplan for Wadable Streams

1999

Prepared for : Idaho Division of Environmental Quality
By: Beneficial Use Reconnaissance Project Technical Advisory Committee

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INTRODUCTION

Creation of the Beneficial Use Reconnaissance Project

In 1993, The Division of Environmental Quality embarked on a pilot program aimed at integrating biological and chemical monitoring with physical habitat assessment characterizing stream integrity and the quality of the water (McIntyre 1993). This program was also developed in order to meet the Clean Water Act requirements of monitoring and assessing biology as well as developing biocriteria. This pilot, named the Beneficial Use Reconnaissance Project (BURP), relied heavily on protocols for monitoring physical habitat and macroinvertebrates developed by ISU and IDEQ in the early 1990s. It closely followed the *Rapid Bioassessment Protocols for Use In Streams and Rivers developed by EPA* (Plafkin et al. 1989). This document was an attempt to use the best science and understanding available to characterize water quality based on biological communities and their attributes. Because of the success of the 1993 pilot, IDEQ decided to expand the project statewide for 1994 (McIntyre 1994; Steed and Clark 1995). The project has remained statewide since 1994.

Purpose

The purpose of the 1999 BURP Workplan is to provide statewide consistency in the monitoring and data collection as described in the *Coordinated Nonpoint Source Water Quality Monitoring Program for Idaho* (Clark 1990).

This document only describes how to conduct data collection for the BURP process. It lays out the assumptions, methods, and equipment required. This document does not describe the analysis and interpretation of the data collected.

Interpretation of BURP data and any other relevant water-quality information is described in IDEQ's Water Body Assessment Guidance (WBAG) document. The WBAG document outlines the process IDEQ uses in determining the support status of designated and existing beneficial uses.

Objectives

BURP Objectives for the 1999 field season are outlined as follows:

1. The state will sample potential Reference conditions/streams.

2. The state will gain better BURP coverage in Hydrologic Units with upcoming Subbasin Assessments and Total Maximum Daily Loads.

Rational for Selected Variables

Physical/Chemical

Flow

Minshall (1993) noted that flow was one of the principal abiotic factors shaping stream ecosystems. Nelson et al. (1992) found flow to be one of the physical attributes that distinguished streams from different geologic regions. Flow is one of a series of measurements taken by both Oregon and Washington in very similar bioassessment projects (Mulvey et al. 1992, Plotnikoff 1992). Flow patterns affect habitat characteristics such as erosion (in part), distribution of aquatic assemblages, and movement of suspended materials (Rankin 1995). Other associated parameters such as discharge and gradient, may provide useful forms of stratification (Rankin 1995). ISU used discharge at base flow to differentiate among intermediate- and large-size rivers (Royer 1997). Discharge information, particularly annual discharge data, may provide an understanding of natural flow patterns and possible impacts to biological communities.

Width and Depth

Width and depth measurements along with discharge data provide meaningful information about stream size and habitat characteristics. These variables have significant impact on the distribution of the aquatic community. Further, grouping rivers by width and depth may be useful for data comparison purposes (IDHW 1996).

Shade

Canopy cover can be a surrogate for water temperature since vegetation can influence the amount of sunlight reaching the stream (Platts et al. 1987). Canopy cover was found to be an important variable in studies by Mulvey et al. (1992) and Overton et al. (1993). Temperature and canopy

cover helped explain differences in fish occurrence and abundance in these studies as well as in the Robinson and Minshall (1992, 1994) ecoregion studies.

Substrate

Fine sediment and its accumulation is detrimental to salmonid spawning (a beneficial use) since it limits the quality and quantity of the inter-gravel spaces that are critical for egg incubation (Maret et al. 1993, Young et al. 1991, and Scrivener and Brownlee 1989). Fine sediment and availability of living space have direct affect on both fish and insects (Marcus et al. 1990, Minshall 1984). Several studies and state projects have found relative substrate size to be important indicators of water quality effects due to activities in the watershed (Overton et al. 1993, McIntyre 1993, Skille 1991).

Habitat Types

An evaluation of habitat diversity is critical to any assessment of ecological integrity. Water velocity, in conjunction with depth, has been demonstrated to have a direct influence on the structure of benthic (Osborne and Hendricks 1983; as cited in Plafkin et al. 1989) and fish (Oswood and Barber 1982) communities. Chapman (1966) stated the physical habitat regulates fish abundance. Researchers have correlated various components of the physical habitat with fish abundance and denoted habitat type as an important factor (Hunt 1969, Graham et al. 1980, Fraley et al. 1981, Shepard et al. 1982, Shepard 1983, Pratt 1984, Irving 1987, Hoelscher and Bjornn 1989, Moore and Gregory 1989). Gorman and Karr (1978) took this relation one step further and found fish diversity, as well as abundance, increased with habitat diversity.

Bank Stability

The removal of stream bank vegetation and soils reduces the structural stability of the stream channel and negatively affects fish productivity (Platts, 1990; Platts & Nelson, 1989). Banks stabilized by deeply rooted vegetation, rocks, logs, or other resistant materials are less susceptible to flow related erosion, reduce water velocity along the stream perimeter, and aid in beneficial sedimentation (Bauer & Burton, 1993).

Riparian Vegetation

The presence and condition of the riparian vegetation is important to the overall ecological health of the river and its floodplain. Healthy stands of riparian vegetation provide habitat for aquatic and terrestrial animals, as well as perform important physical functions (e.g. erosion control, sediment catchment). Stands of naturally occurring riparian vegetation can vary from river to river depending on climate and geomorphology.

Pool Complexity

Pool complexity is a measure of pool quality and pool to riffle ratio is a measure of pool quantity. In a study of streams that differed by the amount of management in their watersheds, Overton et al. (1993) found pools in the less impacted watersheds were more frequent, had higher volumes, and were of greater depth than those in the more impacted watersheds. Beschta and Platts (1986) suggested that pool quality is equally as important as the number of pools in describing a healthy stream from a fisheries standpoint.

Large Woody Debris

Large Woody Debris (LWD), sometimes referred to as "large organic debris", has been found important in smaller sized streams where the riparian zone consists of evergreens, i.e., forested areas (Everest et al. 1987). Large organic debris has been found to be important for the complexity it adds to stream habitats, retention of allochtonous matter and sediment, and stability it imparts to streams under high flow conditions. Some species of salmonids show a high affinity for LWD (Rieman and McIntyre 1993).

Photo Documentation and Diagrammatic Mapping

Photographic records provide visual details concerning riparian conditions and river geomorphology. Diagrammatic mapping is a representative map of the sampling reach. The map provides visual information and an approximate scale of important stream characteristics such as land use, geomorphic channel units, habitat features, and bank conditions (Meador et al. 1993). Such visual details compliment field notes and habitat measurements. This type of documentation may also provide baseline information concerning qualitative changes of riparian conditions, land use and river channel modifications.

Stream Channel Classification

Streams in Idaho exhibit considerable variability in climates, hydrology, geology, land forms, and soils. Recognizing this, the BURP Technical Advisory Committee (TAC) elected to use Rosgen's (1996) Stream Classification System, Level I, as a means of organizing and stratifying streams for comparison. As Conquest et al. (1993) noted, "One way to organize an inherently variable landscape is to employ a system of classification. The general intent of the classification is to arrange units into meaningful groups in order to simplify sampling procedures and management strategies."

Conductivity

Conductivity, or specific conductance, refers to the ability of water to conduct an electrical current. It is an indication of the concentration of dissolved solids. Kunkle et al. (1987) found conductivity to be a useful indicator of mining and agricultural effects. Royer and Minshall

(1996) found sites designated as degraded generally had higher conductivities. Maret et al. (1997) reported conductivity is one environmental factor determining the distribution of fishes.

Biological

Macroinvertebrates

Macroinvertebrates are an essential part of the BURP process. This biological community reflects a stream's overall ecological integrity. Because most streams are monitored infrequently, chemical monitoring is not always representative of the long term condition of the stream. Biological monitoring provides an integrated representation of water conditions and provides better classification of the stream's condition and support status because the biological community is exposed to the stream's condition over a long period of time. This biological assemblage is a useful assessment tool because it is ubiquitous, includes numerous species, and responds to physical and chemical impacts in the water column (Rosenberg and Resh 1993). Additionally, macroinvertebrates with certain environmental tolerances may provide some insight of pollutants (Johnson et al. 1993).

Fish

Fish contribute significantly to the ecology of the aquatic community. This biological assemblage is highly visible to the public and is an important economic resource in Idaho. Additionally, fish have relatively long life spans which can reflect long term and current water quality conditions. Due to their mobility, fish also have extensive ranges and may be useful for evaluating regional and large habitat differences (Simon and Lyons 1995).

Periphyton

Periphyton is a useful indicator because of its wide distribution, numerous species, and rapid response to disturbance (EPA 1996 b). Periphyton integrates physical and chemical impacts because it exists in the water column. Diatoms, a type of periphyton, have frequently been identified as useful biological indicators particularly in Montana, Kentucky, Oklahoma, and European countries (Round 1991, Rosen 1995). Periphyton supplements fish and macroinvertebrate information because of differences in trophic levels, motility and life history (Allen 1995). Additionally, if current fish information is unavailable for a particular river, there will still be data from two other biological assemblages (periphyton and macroinvertebrates) to determine certain support statuses.

Fecal Coliform/E. coli

Fecal coliform, although not a pathogen, is typically an indication of pathogens in the water column. Most streams support secondary contact recreation and a few support primary contact recreation. The State of Idaho has set water quality standards to protect primary and secondary contact recreation beneficial uses (IDAPA 16.01.02.250.01) through numerical criteria such as fecal coliform. A move to more directly measure pathogenic bacteria, such as E. coli, is currently underway within the state . To understand how this change may affect beneficial use assessments both tests, fecal coliform and E. coli, will be completed in 1999.

Amphibians

Amphibians are in apparent decline and may be important water quality indicators (Heyer et al. 1994). For these reasons amphibians found at a stream site should be recorded in the notes section of the field forms. Field identifications can be made using Peterson et al. (1996).

POTENTIAL DATA SOURCES

Review of other data is important when analyzing different water bodies. This cost-effective step should be performed for each sampling reach. As part of the "preplanning" process, the regional office contact should check for available data at resources such as:

- Idaho Department of Fish and Game
- Idaho Division of Health (Health Districts)
- Idaho Department of Water Resources
- Idaho Division of Environmental Quality (internal sources)
- Bureau of Land Management
- Bureau of Reclamation
- Natural Resource Conservation Service
- Tribal Nations
- Universities
- U.S. Fish and Wildlife Service
- U.S. Forest Service
- U.S. Geological Survey
- EDMS (IDWR)
- STORET (EPA)
- Internet searches (if internet access available)
- GIS coverages from IDEQ and other agencies
- Hydropower companies
- Other appropriate resources

Each BURP site must have fish data that is less than five years old. A search for this data is required. The site must be electrofished if no data less than five years old is available and no ESA conflicts arise.

CORE VARIABLES

Core variables will be measured consistently statewide to obtain reliable and comparable data. Measures were selected based on the goal to assess beneficial use support status of wadable streams rapidly and cost-effectively. Table 2. in the methods section lists the core variables, method references, and levels of intensity for each type of waterbody. Some measures directly evaluate beneficial uses while others are surrogate measures for uses that cannot be directly assessed at a reconnaissance level.

WADABLE STREAM METHODS

Criteria to use Wadable Stream Methods

The following criteria must be met:

- Is the sampling reach safely wadable?
- Can the entire protocol for wadable streams be performed?

Site Selection

Idaho has many diverse environments within its borders. Thus, criteria for selecting streams to monitor must be flexible enough to address the range of conditions encountered. To assist in prioritizing monitoring efforts, the Beneficial Use Reconnaissance Project Technical Advisory Committee (TAC) identified the following categories of streams to be considered when the Regional Offices select streams for monitoring:

- Potential reference streams
- Streams attributing to improved BURP coverage in Hydrologic Units with upcoming Subbasin Assessments and Total Maximum Daily Loads

The site selection process is listed in Table 1.

Table 1. BURP Site Selection Process

These steps should be taken in the process of selecting BURP sites:

1) to help insure that sites are representative;
2) to document which order, Rosgen type, land use stratum, etc. the site represents; and
3) to determine how many sites are needed to characterize the beneficial use status of the water body.

Site Selection Steps:

a. photocopy area of USGS map(s) that include the water body to be monitored;
b. determine ecoregion(s) the water body is within;
c. determine gradient from maps using elevation change and stream length ratios;
d. from gradients determine Rosgen stream channel type (A, B, C, etc.);
e. determine stream orders for entire length of water body;
f. identify major land use breaks (forest practices, grazing, agriculture, development, etc.) note: these may be determined or modified when crew gets into the field;
g. select BURP sites within the dominant Rosgen, stream order, land use categories;
h. ground truth the accuracy and apprioriateness of each site in the field and relocate if necessary; and
I. mark the site location on the map and include map and this site selection document in the site or water body file.

Water body name_____

Site ID number_____

Date:_____

Stream Site Selection

The placement and number of BURP sites is a difficult issue to address in a consistent statewide method. There are three major factors that BURP coordinators have identified in selecting sites for monitoring; potential reference, representativeness and access.

Potential Reference

Monitoring least impacted water bodies (often referred to as reference streams) as part of the BURP process is important in evaluating beneficial use support status in Idaho streams. The Guidance to Select Least Impacted Water Bodies and identify Average Range of Reference Conditions for Small Streams in Idaho (IDEQ draft version 2, May 17, 1999) provides a definition and a step-by-step approach to selecting least impacted water bodies. The guidance describes "least impacted" as sites with slight human disturbance relative to an ecoregion; and "average range of reference condition as "the set of selected criteria of least impacted water bodies characteristic of a water body type in an ecoregion". Both of these definitions are from Biological Criteria: Technical Guidance for Streams and Small Rivers (EPA. 1996. Revised Edition. EPA 822-B-96-001).

IDEQs guidance for selecting least impacted water bodies will be reviewed during crew training. The step-by-step approach to selecting least impacted sites will be followed as a core BURP methodology in selecting BURP reference sites.

Representativeness

To apply conclusions to longer stream reaches or entire streams the sample sites must be representative. This sampling can be accomplished by:

1. a "preplanning" office step, which may involve consulting with other resource agency representatives, searching and examining existing stream data, investigating aerial photos;

2. selecting several reaches that cover the potential range of variability determined above; and

3. selecting a few sites in the field that are determined to be the most representative of the stream reach or entire stream.

Robinson and Minshall (1992, 1994) reported ecoregion (Omernik and Gallant, 1986) stratification represented real differences in biotic communities. Currently the BURP process uses ecoregions to stratify streams for comparison to least impacted (reference) conditions. Land use and ownership are also considered.

Ecoregional boundaries are represented by lines on a map. These boundaries do not always depict a sharp change, but rather a gradational change in ecology. When determining which ecoregion a sample site is located within, and the sample site is near a ecoregional boundaries, it is suggested that you evaluate which ecoregion type is most representative of that site.

BURP reaches should not represent multiple stream orders. In other words, if a stream has three orders, then at least one reach per order must be established to determine beneficial use attainability and support status for the entire stream. Regional BURP Coordinators should consider both Rosgen stream type(s) and stream orders in choosing reaches for BURP crews to assess.

Methods

Table 2. 1999 Core Variables List for Wadable Streams
(Q indicates quantitative; S indicates subjective)

Variable	Method Reference	Level of Intensity
Stream Name (Q)	U.S. Geological Survey 1995	standard name
Flow (Q)	Harrelson et al. 1994.	one measurement per site; set interval method
Width/Depth (Q)	Bauer and Burton 1993. pg. 86	measure wetted and bank full conditions at three locations
Shade (Q)	Bauer and Burton 1993. pg. 68	measure with a densiometer at three riffle habitat units; use habitat types and lengths to weight calculations for stream site shade calculations
Bank cover and Stability (S)	Bauer and Burton 1993. pg. 98	longitudinal (total stream site length) for both stream banks
Substrate (Q)	Wolman 1954	at three riffle habitat units; a minimum of 50 counts per riffle; set interval method

Variable	Method Reference	Level of Intensity
Habitat Types (S)	Modified from Schuett-Hames et al. 1992 and Dolloff et al. 1993	determine the type of habitat units present along the longitudinal stream axis. Wetted portions of the main channel are assigned to one of the four habitat types
Pool Complexity (Q,S)	Bauer and Burton 1993. pg. 119	measurements taken in a minimum of four pools, length, maximum width, maximum depth, and depth at pool tailout
Large Woody Debris (Q)	Platts et al. 1987. pg. 83	LWD > ten centimeters diameter and > one meter in length; within bank full zone of influence (applicable only in forested situations)
Stream Channel Classification (Q)	Rosgen 1996	Level I to letter classification only (A,B,C, etc.)
Habitat Assessment (Q, S)	Hayslip 1993	follow habitat assessment protocol
Temperature (Q)	Franson 1998	instantaneous temperature measurements
Photopoints (Q)	Cowley 1992	photographs upstream and downstream at lower end of each site; record directions in which photographs are taken
Conductivity (Q)	Franson 1998	measure each parameter at transect 1 using a calibrated conductivity and temperature meter
Latitude/Longitude (Q)	Trimble 1995	collect GPS data and differentially correct
Biological Variables		
Macroinvertebrates (Q)	Clark and Maret 1993	Hess sampler, with 500 µm mesh at three riffle habitat units (n=3); samples preserved and stored separately in the field; laboratory

Variable	Method Reference	Level of Intensity
Fish (S, Q)	Modified from Chandler et al. 1993	collect fish in the study site or an equivalent length of stream which includes all habitat types encountered in the study site; collect, count, and voucher specimens (6 individuals if possible, or as the permit allows) for each species; measure total length of all species.
Bacteria Screening process (S)	Franson 1998 Standard Methods 20th edition	if screening process indicates collection required: 250 ml sterile milk dilution bottles; pre-rinsed with sodium thiosulfate; collect bacteria grab samples at thalweg of stream; cool to 4°C; delivery to laboratory within 30 hours. (State Laboratory requests 24 hours); 1 to 5 samples per site
Periphyton (Q)	Bahls 1993	collect from three separate riffle habitats using a modified syringe and brush, composite and preserve with 5-10 drops of 2% formalin solution.

Description of Methods and Modifications

Flow

Locate a straight non-braided stretch of your sampling reach. Place a measuring tape across the stream perpendicular to the flow. Take evenly spaced velocity measurements from wetted bank to wetted bank so that no more than 5% of the total discharge is in each (partial cross-section) (Harrelson et al., 1994). Record the horizontal distance measured from the tape and record depth and velocity from the top-setting wading rod and electromagnetic velocity meter. On very narrow streams with homogenous depth and substrate, >10% of the total discharge in any partial cross-section, or cell, is acceptable for reconnaissance level monitoring purposes. Also note: for depths ≥2.5 feet, two velocity measurements are taken for each partial cross-section; one at 20% of total depth and a second at 80% of total depth.

Width/Depth

Although high accuracy using measurement methods for streams < 100 feet wetted width has been reported (Platts et al., 1983) the following protocol was developed to provide meaningful resolution without the encumbrance of multiple measurements.

At each BURP site a transect is established 10 meters upstream of each macroinvertebrate collection location. Procedure is conducted from the left bank to the right bank while facing upstream.

- Stretch, secure, and level tape across bank full (BF) width.
- Measure and record BF width.
- Measure and record the vertical distance from the tape at BF elevation to the left wetted edge (LWE).
- Measure and record wetted width (WW).
- Measure and record wetted depth (WD) from the water surface to the channel bottom at evenly spaced increments across the wetted width according to the following guideline: (intervals calculated by WW divided by n+1)

WW	# measurements(n)
≤ 1 meter	3
> 1 but ≤ 4 meters	5
> 4 meters	7

- Calculate and record average wetted depth (AWD).

When a width/depth transect is measured in a split channel, there are two ways to make the measurement. Bankfull measurements should be taken in the channel with the most discharge if the area between the channel is above the ordinary high water level. Bankfull measurements should be taken across both of the channels if the area between the channels is below the ordinary high water level. Bankfull stage will be identified using, in part, Leopold et al. (1995).

Shade

Use a concave spherical densiometer to determine canopy cover. The number of densiometer grid intersections obstructed by overhead vegetation is recorded. Densiometer readings are taken at three riffle habitat units. Densiometer measurements should be taken on the riffle relative to where the macroinvertebrate samples were taken. For stream orders 1-4 the following four readings are taken per cross section; right bank, left bank, from the center of the stream facing upstream, and from the center of the stream facing downstream. The densiometer should be held one foot above the water surface for all measurements and one foot in from the banks when taking right and left bank measurements (see Figure 1).

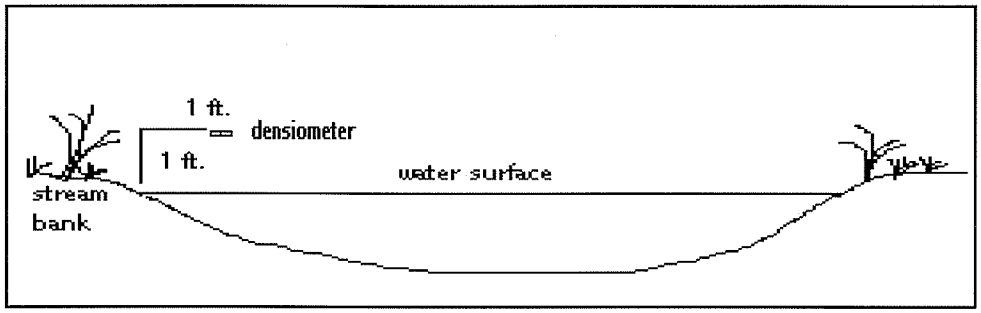

Figure 1. Position of densiometer when measuring at right and left wetted edges (1 ft in from stream bank and 1 ft above water surface; facing the bank).

Stream Bank Cover and Stability

Using a modified version of Bauer & Burton (1993), the stream bank is categorized as covered and stable, covered and unstable, uncovered and stable, or uncovered and unstable. Banks are defined as covered if they are typified by a 50% coverage of perennial vegetation or their roots, rocks of cobble size or larger, or logs greater than four inches is diameter (Bauer & Burton, 1993). Banks are defined as unstable if they are typified by fractured banks, bank slumping, or vertical and eroding banks (Bauer & Burton, 1993).

Stream bank condition is determined on the left bank and the right bank of the waterbody. Using a two meter stick or a tape, the BURP crew measures the total number of meters of stream bank that fall into each of the four categories. These values are used to calculate what percent of the reach is characterized by each of the four bank conditions.

Substrate

The BURP process uses a modified Wolman Pebble Count (Wolman 1954) to quantify substrate size distribution in riffle habitats. This BURP pebble count method relies on surface fines (defined as material <6.35 mm Chapman and McLeod 1987) as an index of sedimentation and beneficial use impairment.

Pebble counts (substrate measurements) are conducted at the same three transects in the riffle habitat units where macroinvertebrates were sampled. Begin at the bank full level on one stream bank and proceed across the riffle to the bank full level on the opposite stream bank. Select pebbles at equal distant intervals (heel to toe, one pace, each foot on a tape, etc.). At each interval, reach to the stream bottom, pick up the first particle touched, and measure the intermediate axis. Record on the BURP Field Form the size class of the particle and whether the particle was chosen from within the wetted stream channel. Replace the particle down stream of the transect line. Conduct the pebble count with as little bottom disturbance as possible. A minimum of 150 particles measured from three riffles (50 per riffle) is required. Record measurements until the bank full streambank is reached, even if the 50 counts are reached before a transect is completed. Each successive pass must be upstream from the previous pass if multiple passes are required to reach the minimum 50 pebbles per riffle.

Habitat Typing

A variety of habitats occur in wadable streams. Visual determination of habitat units can be subjective with poor precision because they are not clearly defined (Platts 1982). The Western Division of the American Fisheries Society formed a committee to standardize definitions related to habitat evaluations (Helm et al. 1985). Others have combined types into macrohabitat units thereby improving observer recognition and the ability to replicate surveys in the future (Schuett-Hames et al. 1992). Macrohabitat units have equivalent structure, function, and responses to disturbance.

Oswood and Barber (1982) proposed four general categories or macrohabitat units based on velocity and depth relations: slow and deep, slow and shallow, fast and deep, and fast and shallow. These correspond to pools, glides, runs, and riffles. These habitat types will be differentiated by the following characteristics.

- **Pool**-A portion of the stream with reduced water velocity, water deeper than the surrounding areas, the bottom often concave in shape forming a depression in the profile of the stream's thalweg, and that would retain water if there were no flow. Pools usually occur at outside bends (e.g. lateral scour) and around large obstructions (e.g. plunge pool). Pocket water pools refer to groups of small pools often in areas of otherwise fast or turbulent flow, usually caused by eddies behind boulders or other obstructions. Eddies

are also associated with backwater pools. Water impounded upstream from channel blockage, typically caused by a log jam or beaver dam, is classed a dammed pool. Flats are actually a wide shallow pool often confused with a glide. Pools end where the stream bottom approaches the water surface, also known as the pool tailout.

- **Glide**- A portion of the stream with slow moving, relatively shallow water. The waters surface has little or no turbulence and the stream bottom is flat or slightly convex in shape lacking the scour associated with the pool. Glides are typically situated downstream of pools in the transition between the pool and the crest of the riffle. The riffle crest restricts water flow and slows the water in glides. Glides also occur where the channel widens allowing the stream to shallow and slow. Glides are most commonly found in low gradient streams associated with elongated pools.

- **Riffle**- A portion of the stream with swiftly flowing, shallow water. The waters surface is turbulent. The turbulence is caused by completely or partially submerged obstructions, often the stream bottom. Cascades are one class of riffle characterized by swift current, exposed rocks and boulders, considerable turbulence, and consisting of stepped drops over steep slopes. Riffles that are swift, relatively deep, and have considerable surface turbulence, sometimes represented by standing waves, are called rapids. Rapids at high flow may be confused with runs.

- **Run**- A portion of the stream with swiftly flowing, relatively deep water, which approximates uniform flow. There are no major flow obstructions causing little or no surface turbulence. Runs tend to occur immediately upstream and downstream of riffles. Pool tailouts are typically classed as runs in small, high gradient streams. A narrow, confined channel through which water flows rapidly and smoothly, usually with a bedrock substrate, is called a chute. Chutes are a class of runs.

The classification of habitat units is geomorphic and flow dependent and may change with a change in discharge. It is recommended the observer "calibrate" their eye to the type of stream (e.g. spring creek, freestone creek) and local conditions; form a mental image of the various habitat types that should persist given the current conditions.

Once "calibrated", determine the type of habitat units present along the longitudinal stream axis. Wetted portions of the main channel are assigned to one of the four habitat types. Complexes of multiple habitat units may be encountered. Individual habitat types should be recorded if the unit occupies more than 50% of the wetted channel width. Minor habitat units should be combined with the adjacent unit.

Pool Complexity

Pool complexity is measured at a minimum of four pools if pools are present at the site. Pool length, substrate, overhead cover, submerged cover, bank cover, maximum pool depth, maximum pool width, and depth at pool tailout are measured at each pool.

Large Woody Debris

All LWD greater than ten centimeters in diameter and one meter in length is counted within the bankfull channel throughout the site. The requirements for minimum diameter and length are provided on the field form. This parameter only applies to streams in forested situations. Occasionally, sites will be encountered with large accumulations of LWD. At these sites, it is acceptable to count up to 100 pieces than estimate thereafter, i.e., <100 pieces of LWD in site, count individually, >100 pieces in site, count by tens. When dealing with large amounts of LWD each piece counted must meet the minimum size requirement.

Photo Documentation

Each crew is supplied with slide film, date back cameras, and compasses. Two photos are taken of the stream site from the lower end of the site. One photo is taken facing upstream and one facing downstream. Recording the azimuth in which each photo is taken is optional.

Stream Channel Classification

Determine the Rosgen stream type to Level I only. Determine the following:

- Latitude
- Longitude
- Elevation
- Slope
- Stream Order
- Valley Type

Additional descriptive items that may be collected in the field or in the office before and after the assessment is made.

- Aspect
- Lithology

Conductivity

The crew is to measure conductivity at transect 1 using a calibrated conductivity-temperature system.

Macroinvertebrates

Macroinvertebrate samples are collected from three separate riffle habitat units following Clark and Maret (1993). Using a Hess sampler take an invertebrate sample by stirring substrate and brushing rocks for a minimum of two minutes (strive for a consistent time of 3-5 minutes per sample). Place the sample into a container, label inside and out, and preserve with 70% ethanol (container should be filled to shoulder). If container is greater than 50% full of sample material, contents should be divided into two containers of fresh alcohol or rinsed with 70% ethanol three times within 24 hours.

Each of the three samples will be preserved separately for laboratory compositing. The first 500 individuals will be counted and identified.

Fish

The collection of fish is a core variable for the 1999 BURP season. If applicable fish data less than five years old exist for the BURP reach, the site does not need to be sampled.

Core Methods

- Obtain fish collection permit or cooperate electrofishing effort with permitted personnel.
- The site surveyed for fish should include all habitat types present in the reach if different than the BURP site.
- Electrofish the site. Electrofish after macroinvertebrates have been collected and before habitat measurements are taken if a BURP site.
- The survey should include one upstream pass without block nets as a minimum reconnaissance level effort. Proceed up the thalweg of the channel for streams less than five meters wetted width and in a zig-zag pattern on larger streams. Sample all habitat types.
- Collect all fishes.
- Identify all fish to species.
- Prepare equipment to measure length (weight scales optional) and recovery chamber prior to applying anesthesia.
- Apply anesthesia as recommended in Chandler et al. (1993).

- Measure total length of all fish including the family Salmonidae. Salmonids occurring in Idaho include rainbow trout/steelhead trout, cutthroat trout, rainbow/cutthroat trout hybrids, brook trout, bull trout, brook/bull trout hybrids, brown trout, brook/brown trout hybrids (tiger trout), lake trout, brook/lake trout hybrids (splake), golden trout, kokanee/sockeye salmon, coho salmon, chinook salmon, lake whitefish, mountain whitefish, Bear Lake whitefish, pygmy whitefish, Bonneville whitefish, Bonneville cisco, Atlantic salmon, and arctic grayling. If hundreds of young-of-the-year are collected, a random subsample of the total catch of each salmonid species may be measured for total length. All young-of-the-year should be counted.

- Count and measure each fish of non-Salmonidae families collected.

- Voucher up to six (6) specimens of each species as the fish collection permit allows. This is especially important for any fish that cannot be identified to species in the field. Voucher according to Appendix IV. Make a one inch incision along the right side of fish greater than 250 mm.

- Tag each vouchered fish and mark field form for tracking purposes.

- Record the amount of electrofishing effort (time) spent on the site. Record the effort (time) for each pass if multiple passes are made.

- Measure and record the conductivity.

- Measure and record the water temperature.

- Record water clarity (clear, stained, lightly turbid or highly turbid).

- Record the proportion of habitat types within the site on the fish data sheet if different than the BURP site.

- Record stream length and average width (minimum of three transect measurements) of the site electrofished if different than the BURP site.

- Electrofish a minimum of 100 meters of stream and strive for all habitat types present.

Bacteria

The collection of Bacteria is a core variable for the 1999 BURP season. However, following the screening process to determine if Bacteria collection is required for each site. If screening

process indicates bacteria collection is not required for the BURP reach, the site does not need bacteria collections.

- Is primary contact recreation a designated beneficial use?
    - Apply primary contact recreation threshold values for exceedances.
- Are swimming/bathing areas located within the reach; is there evidence of swimming/bathing within the reach; has swimming/bathing been observed in the reach?
    - Apply primary contact recreation threshold values for exceedances.
- Do upstream land uses have potential for increasing bacteria concentration? (Activities affecting reach: agriculture, grazing, urban, or waste water treatment facilities, cabins, or septic tanks, etc. in reach.)
    - Apply secondary contact recreation threshold values for exceedances.
- Are there other reasons that bacteria should be collected? For example, has the stream had bacteria problems in the past? Has the public filed complaints on the stream? Are there other reasons to expect a bacteria problem? If so provide a detailed justification.
    - Apply secondary contact recreation threshold values for exceedances.
- If any of the above questions were answered yes, collect one sample. If an exceedance of the applicable threshold value occurs, follow up by collecting five (5) samples within a thirty day period.

To determine if an exceedance has occurred, refer to the Idaho Water Quality Standards, IDAPA 16.01.02.250.01. The threshold values for fecal coliform bacteria are: 500 colonies per 100 ml for Primary Contact Recreation and 800 colonies per 100 ml for Secondary Contact Recreation. The proposed standard changes and threshold values for e. coli bacteria are: 406 organisms per 100 ml for Primary Contact Recreation and 576 organisms per 100 ml for Secondary Contact Recreation.

Periphyton

The collection of Periphyton is a **required** variable for the 1999 BURP season. It will be stored and analyzed when a second biological assemblage is needed for evaluation purposes when fish data is absent.

Samples are collected from three separate riffle habitats using a modified 30cc syringe and a small, stiff bristled brush. Collection should occur in the same habitats as the macroinvertebrate samples. Randomly choose a stone from the wetted stream channel and carry it to the bank, making sure that the portion of the stone that is exposed to the sun remains on top. Firmly press the modified syringe over the stone and add a small amount of water using an aspirator or eye dropper. Place the brush into the syringe and scrub the surface of the stone until the attached algae are loose. When the algae have been sufficiently dislodged from the rock, use the aspirator to remove the mixture and place it into a 15ml scintillation vial. Combine the samples from all three riffles into one composite sample, fill the sample to the top and preserve with 7-10 drops of 2% formalin for a 15 ml vial collection (see Appendix XI) solution.

Amphibians

Amphibians are an optional variable. Several specimens should be collected of each taxon for positive identification purposes and to act as vouchers for our work. Amphibians can be killed in weak ethyl alcohol solutions, in hot water, or in chlorotone. This can be done in an opaque plastic bottle. The specimens should then be preserved in a 10% formalin solution. Large specimens require a small incision in the body wall to allow for proper internal preservation. Later (in the Museum) the specimens can be transferred into 70% ETOH.

Voucher specimens of amphibians should be deposited in a regional museum (Bury and Corn 1991). Our specimens will be deposited in the Orma J. Smith Museum of Natural History, Albertson College of Idaho, Caldwell, and the Idaho Museum of Natural History, Idaho State University, Pocatello.

Recommended Procedure Sequence For Site Evaluation

- Take pre-field steps to gather all existing chemical, physical habitat, and biological data residing with other federal and state agencies or entities, with the aim of identifying potential sampling sites.

- Determine the appropriate site to survey in the field. The minimum site length should be 40 times the wetted width or 200 meters, whichever is larger.

- Measure the appropriate distance and mark beginning and ending points with flagging, being careful to stay out of stream. The downstream end of the measured length of stream is considered the beginning.

- Take photographs of the site and record GPS coordinates, photo point, and map location.

- Fill out the descriptive cover sheet information, i.e., stream slope and Rosgen stream type, stream order, crew members' names, weather, location relative to some reference landmark, stream temperature (measured with a thermometer), general observations, etc.
- Complete Bacteria screening process.
- Collect bacteria samples if screening process indicates and the holding time (30 hours) permits.
- Measure conductivity.
- Measure stream discharge by choosing a location with a relatively straight channel and uniform flow, where possible.
- Locate the first riffle upstream from beginning point.
- Randomly select a location for macroinvertebrate sampling following these steps:

  1. stretch a tape along one bank from the lower to the upper end of the riffle;
  2. generate a random number on the tape;
  3. stretch the tape across the riffle at this random location; and
  4. generate a random number and locate on "cross-riffle-tape" and place the sampler (Hess or Surber) at that location.

- Collect a macroinvertebrate sample.
- Collect a periphyton sample.
- Conduct fish sampling (electrofishing, et cetera) if it is to be done.
- Conduct a pebble count immediately upstream from the macroinvertebrate sample transect.
- Measure canopy closure (shade) at the riffle habitat unit transect where macroinvertebrates were collected. Measure at right and left bank and in the middle of stream facing upstream and another facing down stream.

- Measure width and depth of the stream 10 meters above the riffle habitat unit transect where macroinvertebrates were collected.
- Proceed to a mid-site riffle habitat unit and repeat macroinvertebrate collection, periphyton collection, pebble count, canopy closure and width/depth measurements
- Proceed to an upper-site riffle habitat unit and repeat macroinvertebrate collection, periphyton collection, pebble count, canopy closure and width/depth measurements
- Conduct habitat type measurements by measuring and characterizing as either pool, riffle, run, or glide. Express this on the field forms by percent of total length surveyed.
- Assess pool complexity at a minimum of three pools within the site. Follow the pool definition described under "Habitat Types" in selecting pools.
- Conduct a bank stability survey by rating each bank for the four different categories noted on the field forms; covered and stable, covered and unstable, uncovered and stable, and uncovered and unstable. Express ratings as percentages. Use the tape that was used for obtaining the riffle/pool measurement or use a two meter pole.
- Complete the Habitat Assessment form at the site.

QUALITY ASSURANCE

Quality Assurance

Collection of reliable and accurate monitoring and measurement data is the goal of the quality assurance (QA) program in the BURP process. The five aspects of IDEQ's quality assurance program aimed at enhancing reliability, accuracy, and consistency are: 1.) crew supervision, 2.) regional BURP Coordinator Workshops, 3.) regional crew training, and 4.) field reviews.

Crew Supervision

Each BURP crew is provided with supervision throughout the monitoring season. The IDEQ Regional BURP Coordinators are involved during the training period and then accompany crews periodically throughout the monitoring season. BURP Coordinators are trained annually through

the BURP Coordinator Workshops where they are refreshed on BURP protocol, learn new BURP methods, and exchange ideas on improving data collection efficiency and accuracy.

Coordinator Workshop

A coordinator workshop is conducted prior to each monitoring season. The workshop provides:

- transfer of training materials and instruction methods;
- training on new methods; and
- statewide consistency of monitoring methods.

The IDEQ state office staff coordinate and facilitate these workshops. Each IDEQ Regional BURP Coordinator and Central Office BURP staff is randomly assigned parameters to present at the workshops. Presentations include:

- a copy of the relative sections of referenced protocol;
- printed recommendations of training methods; and
- an example of properly recorded measurements.

The materials presented at these workshops are combined into an annual reference document that is used in regional crew training. These workshops include training on all the existing BURP methods plus new or modified methods.

Crew Training

Following the BURP Coordinator Workshop, IDEQ Regional BURP Coordinators conduct training of crews within their regions. The regional crew training covers all aspects of the BURP process whether training is a refresher for veteran crew members or first time for new crew members. Training provides a chance for hands-on experience in each parameter for each BURP crew member.

Field Audits

A field audit consists of one or more of the IDEQ State Office Technical Services staff, accompanied by a Regional Office Coordinator from another DEQ region, observing BURP crews performing measurements and collecting samples from a site. Audits are scheduled to occur within approximately two weeks of crew training. Each crew will have at least one audit per season. During a field audit, the audit team will inspect a crew measuring, collecting, and

preserving samples. The audit team, using predefined standards, will determine whether or not data generated from the audited monitoring effort is acceptable.

A briefing will be provided on-site after completion of the audit and a written report prepared by the IDEQ State or Regional Office staff will be completed immediately following the field audit. This report will be provided to the IDEQ Regional Monitoring and Technical Support Supervisors, IDEQ Regional BURP Coordinator, and the appropriate Technical Services and water program managers.

Biological

Macroinvertebrates

Field

Care should be taken not to damage the invertebrates during all phases of sample collection. All sample handling of macroinvertebrates in the field should all be done over a white pan. This includes the process of transfer of the sample from the net to the sample container. Any sample that is found in the white pan following sample processing can be washed into the sample bottle with ethyl alcohol (ETOH) (see Appendix XI). The macro invertebrates must be preserved in 70% ETOH. If the sample is high in organic matter or water it may need to be preserved with a higher strength of ETOH. In addition, if the sample contents fill the sample container to a level greater than 50% the sample should be divided into two or more containers. In cases where a single sample is divided into more than one container the sample labels and field data forms should clearly reflect the sample identity.

After sampling is completed at a given transect, all brushes, nets, and other items that have come in contact with the sample must be rinsed thoroughly, examined carefully, and cleaned of any algae or other debris. All equipment should be examined again prior to use at the next BURP site and recleaned if necessary to avoid sample contamination.

The sample labels must be on archival grade heavy paper that is able to withstand storage in alcohol (we recommend Resistall Paper 36#). Alcohol proof ink must be used for the field information that is entered onto the label. A label should be placed inside the jar as well as taped to the outside of the jar.

Laboratory QA/QC

Laboratory QA/QC is addressed in the scope of the 1999 macroinvertebrate identification and enumeration Request For Proposal(RFP). Standard taxonomic effort (STE) is an important

aspect of the laboratory analysis of macroinvertebrate samples (Plotnikoff and White 1996). The Laboratory and/or its designees follow Plotnikoff and White (1996) (this is currently being revised for Idaho by EcoAnalysts, Inc.), or latest IDEQ approved method, to determine STE for macroinvertebrate groups in Idaho.

Voucher specimens of all organisms collected are stored in glass vials of 70% ETOH (Clark and Gregg 1986) with proper locality, date, collector, and determination labels. These specimens are then available for any later verification that might be needed and for future research opportunities. The specimens are deposited in the Orma J. Smith Museum of Natural History, Albertson College of Idaho, Caldwell.

Fish

Care should be taken in the following:

- Extreme care should be taken to avoid damage or injury to fish.
- Apply anesthesia as needed/recommended.
- Assure that all collected fish are maintained in well oxygenated water.

Voucher specimens according to vouchering procedure. Label all voucher containing containers using archival grade heavy paper that is able to withstand storage in formalin solution (we recommend Resistall Paper 36#). Alcohol proof ink must be used for the field information that is entered onto the label. A label should be placed inside the jar as well as taped to the outside of the jar.

Fecal Coliform/E. coli

The Regional Offices will perform quality assurance on all the collected samples. Quality assurance for bacteria sampling involves using field blanks. On ten percent of all samples, a "BLANK" sample container and laboratory prepared "BLANK" water accompanies the empty sample containers into the field. At one designated site, the "BLANK" is opened for a few seconds and is filled with the prepared water supplied by the laboratory. This procedure duplicates handling, storage and transportation of sample containers.

All samples are submitted to the designated laboratory within 30 hours of collection. The samples are placed on ice and cooled to approximately 4°C for transportation. If necessary, samples are stored in a "sample storage refrigerator" at the nearest IDEQ regional office.

Proper labeling and field documentation are conducted to demonstrate compliance with sampling protocol and to reduce mishandling of sample bottles.

Periphyton

Care should be taken to make sure that the side of the rock exposed to sunlight in the stream is the side the sample is collected from. The periphyton samples must be preserved in 2% formalin solution. All sample containers must be labeled using labels printed on archival grade heavy paper that is able to withstand storage in formalin solution (we recommend Resistall Paper 36#). Alcohol proof ink must be used for information that is entered onto the label. A label should be placed both on the inside of the container as well as taped to the outside of the container. Containers must be stored in a dark location until analysis.

Quality Assurance and Data Handling

Data handling by BURP crews and Coordinators prior to submittal to State Office is considered part of the sampling process. Once received by the SO the data enter the data handling process. Specifics of the QA for data handling can be found in the most recent version of "Data Handling QA/QC Manual for Wadable Streams for the 1999 Beneficial Use Reconnaissance Project (BURP) Data" (IDEQ, 1999). Generally, the QA process requires review of data sheets by the IDEQ State Office QA crew and data entry by the IDEQ's Information Services Bureau.

Safety and Training

All BURP crew members, Regional Coordinators, and State Office Technical Team staff will be trained and certified in cardio-pulmonary resuscitation. This requirement will increase safety during electrofishing, training, and BURP field work. The BURP crews will be trained by the IDEQ "in-house". For electrofishing safety procedures see appendices VI-VIII. For safe handling of formalin see Appendix X. Crew safety is the primary concern.

Data Analysis and Interpretation

This document describes how to conduct a survey following the BURP process. It describes how a BURP survey is conducted: assumptions, methods, data handling, and equipment required. This document is not intended to describe the analysis and interpretation of the data collected.

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Glossary

abiotic - applied to the non-living, physical, and chemical components of an ecosystem, as distinct from the biotic or living components.

attainable use - a beneficial use that, with improvement, a waterbody could support in the future

aufwuchs - a German word that means "to grow upon" and more or less synonymous with the term benthic algae. The term is not commonly used in the modern literature.

beneficial use - any of the various uses that may be made of water, including, but not limited to, water supply (agricultural, domestic, or industrial), recreation in or on the water, aquatic biota, wildlife habitat, and aesthetics.

criteria - either a narrative or numerical statement of water quality on which to base judgement of suitability for beneficial use.

designated use - a beneficial use listed for a waterbody or waterbodies in a state's water quality regulations.

discharge - commonly referred to as flow, expressed as volume of fluid per unit time (e.g. cubic feet per second) passing a particular point, in a river or channel or from a pipe.

existing use - a beneficial use actually attained by a waterbody on or after November 28, 1975.

eutrophication - the process of nutrient enrichment in aquatic systems, such that the productivity of the system is no longer limited by the availability of nutrients. This is a natural process but may be accelerated by human activities.

Escherichia coli - This bacteria, often referred to simply as *E.coli*, is found in the normal intestinal flora of warm blooded animals. It is pathogenic and its presence in water indicates that the water has been in contact with or contaminated by fecal material.

integrity - the extent to which all parts or elements of a system (e.g. aquatic ecosystem) are present and functioning.

monitoring - to check or measure water quality (chemical, physical, or biological) for a specific purpose, such as attainment of beneficial uses.

nonpoint source - referring to pollution originating over a wide geographical area, not discharged from one specific location.

periphyton - a term for benthic algae which is commonly used to refer to all of the microflora on substrata.

point source - any discernable, confined, or discrete conveyance of pollutant, such as a pipe, ditch, or conduit.

pollution - any alteration in the character or quality of the environment due to human activity that makes it unfit or less suited for beneficial uses.

reconnaissance - an exploratory or preliminary survey of an area.

reference conditions - conditions which fully support applicable beneficial uses, with little impact from human activity and representing the highest level of support attainable.

surface water - the collection of all natural bodies of water, including but not limited to streams, lakes, and wetlands, evident on the surface of the land.

thalweg - a line joining the deepest points along successive cross-sections of a river channel.

waterbody - a specific body of water or geographically delimited portion thereof.

water quality - a term for the combined chemical, physical, and biological characteristics of water which affect its suitability for beneficial use.

wastewater - treated or untreated sewage, industrial waste, or agricultural waste and associated solids.

APPENDIX I. FIELD EQUIPMENT CHECK LIST

APPENDIX I. FIELD EQUIPMENT CHECK LIST

Equipment Description	Yes	No
MACROINVERTEBRATE SAMPLE EQUIPMENT:		
Hess and Surber Sampler (500 µm mesh w/300 ml bucket)		
White pans		
Kick nets		
Macro sample containers		
Preservative (70% ethanol)		
Spare nets for Samplers		
Scrub brush		
(squirt) bottles for rinsing (water and alcohol)		
Field labels		
Field Data Forms		
Rubber gloves		
Forceps		
Pencils/Indelible alcohol proof markers		
ELECTROFISHING EQUIPMENT:		
Electrofisher		
Anode and Cathode		
Dip nets		
Waders		
Rubber gloves (shoulder length)		

Equipment Description	Yes	No
Specific Conductivity Meter		
Preservative: 10% buffered formalin solution		
Scales (weight (springs) & length)		
Thermometer		
Collecting Permit or IDFG personnel		
Anesthetic		
Buckets		
Gas/oil		
Generator (if using a battery powered electrofisher) + spare parts		
Specimen vouchering containers		
Fish measuring board		
Fish identification keys		
Clipboard/notebook/fish labels		
Field data sheets		
First Aid Kit		
Polarized sunglasses		
Fire extinguisher		
CPR Certification		
WOLMAN PEBBLE COUNT EQUIPMENT:		
Metric ruler (clear plastic) or angled measuring device listed in Protocol #2		
Shoulder length gloves		

Equipment Description	Yes	No
Pencils/pens		
Field data sheets		
FLOW MEASUREMENT EQUIPMENT:		
Current velocity meter		
Top-setting-wading rod		
100 ft. measuring tape (minimum length)		
Rebar stakes		
Flow sheets		
Pencils/clipboard		
Waders		
Extra batteries for current meter		
BACTERIA SAMPLING EQUIPMENT		
Bacteria check sheet		
Steralized bacteria sample bottles		
Labels/label tape		
Editable marker		
Cooler with ice		
PERIPHYTON SAMPLING EQUIPMENT:		
Periphyton sampler		
Periphyton brush		
Pipette		
2% formalin solution & dropper		

Equipment Description	Yes	No
Labels		
MISCELLANEOUS EQUIPMENT:		
Densiometer		
2 meter rod		
Polarized sunglasses		
Tape measures		
Random number table		
Field notebook/clipboards		
Maps		
"All" forms and labels		
Sunscreen		
Camera & film		
Extra batteries		
Emergency equipment for vehicle		
First aid kit		
GPS receiver		
Current Beneficial Use Reconnaissance Project Workplan		
IDEQ/Other Protocols		
Tool Kit		
Pens/pencils		

APPENDIX II. 1999 BURP FIELD FORM

1999 Beneficial Use Reconnaissance Project Field Forms
Idaho Division of Environmental Quality

Site Identification

Stream Name: _____ Site ID: 1999S Date (YY/MM/DD): 99

HUC: _____ PNRS: _____ WB ID No.: _____

Public Land Survey: Twnshp _____ Range _____ Section _____ _____ 1/4 of the _____ 1/4 of the _____ 1/4

Latitude: _____ Degrees _____ Minutes _____ . _____ Seconds Longitude: _____ Degrees _____ Minutes _____ . _____ Seconds

Datum: NAD83 _____ NAD27 _____ Other _____ Lat/Long Confidence: 2-5 meters _____ 100 meters (raw) _____ 500 meters (estimate) _____

Corrected Latitude: _____ Degrees _____ Minutes _____ . _____ Seconds Longitude: _____ Degrees _____ Minutes _____ . _____ Seconds

GPS File _____ County: _____ Ecoregion: _____ Map Elevation (ft or m) _____

Location Relative to Landmark: _____

Weather Conditions: _____ Crew Members: _____

Data Collection

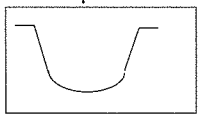
General Wetted Width: _____ meters Total Reach Length: _____ (40 X wetted width or100 m minimum)

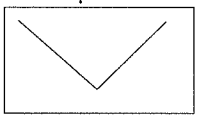
Stream Order: 1 2 3 4 5 (circle one) Stream Gradient: _____ % Rosgen Stream Type: _____

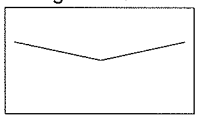
Temperature: _____ Time: _____ Amphibians Observed: _____

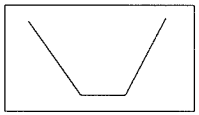
Conductivity: _____ Fish Observed: _____

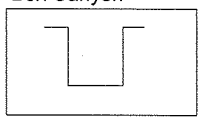
Valley Type: circle one

U - Shape 

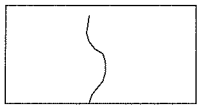
V - Shape 

Trough - Like 

Flat Bottom 

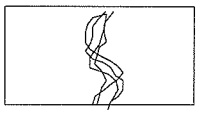
Box Canyon 

Sinuosity: circle one

Low 

Moderate 

High 

Braided 

Activities Affecting Reach

Circle All That Apply:

Forestry Mining
Agriculture Roads
Recreation Urban
Diversion Grazing
Wilderness
Beaver Complex
Other: _____

*describe all in notes

Additional Information (include riparian composition and status):

1999 Beneficial Use Reconnaissance Project Field Forms

Stream Name: _____ Site ID: 1999S Date (YY/MM/DD): 99

Additional Information (continued):

1998 Beneficial Use Reconnaissance Project Field Forms

Stream Name: _____ Site ID: 1999S Date (YY/MM/DD): 99

Discharge Measurement

	Tape	Width	Depth	Area	Velocity	Velocity	Dischrge
	ft	ft	ft	sq ft	ft/sec	ft/sec	cfs
LWE							
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
RWE							
					Total Flow		

MacroInvertebrate Samples

Were samples taken during period of July 1 through October 15?

Yes No

Sample No. 1

Label: _____

Sampler Used: Hess Surber Kick

Habitat Sampled: Riffle Run Glide Pool

Time: _____

By: _____

Split: Yes No

Sample No. 2

Label: _____

Sampler Used: Hess Surber Kick

Habitat Sampled: Riffle Run Glide Pool

Time: _____

By: _____

Split: Yes No

Sample No. 3

Label: _____

Sampler Used: Hess Surber Kick

Habitat Sampled: Riffle Run Glide Pool

Time: _____

By: _____

Split: Yes No

1999 Beneficial Use Reconnaissance Project Field Forms

Stream Name: _____ Site ID: 1999S Date (YY/MM/DD): 99

Wolman Pebble Count (Modified)

Particle Size	Riffle 1 Within Wetted	Riffle 1 Outside Wetted	Riffle 2 Within Wetted	Riffle 2 Outside Wetted	Riffle 3 Within Wetted	Riffle 3 Outside Wetted
silt/clay 0-1 mm						
sand 1.1-2.5 mm						
very fine pebble 2.51-6 mm						
Subtotal						
pebble 6.1-15 mm						
coarse pebble 15.1-31 mm						
very coarse pebble 31.1-64 mm						
small cobble 64.1-128 mm						
large cobble 128.1-256 mm						
small boulder 256.1-512 mm						
medium boulder 512.1-1024 mm						
large boulder 1024.1 mm &larger						
Total						

Large Woody Debris

Total number of pieces larger than 10cm diameter and 1m length:

*Within Bankfull

Canopy Closure

	Riffle 1	Riffle 2	Riffle 3
Left Bank*			
Center Up			
Center Down			
Right Bank*			

*Facing Upstream

1999 Beneficial Use Reconnaissance Project Field Forms

Stream Name: _____ Site ID: 1999S Date (YY/MM/DD): 99

Width/Depth Ratio

	Bankfull Width(m)	Wetted Width(m)	Bankfull Height(m)	Avg Wetted Depth(m)	Wetted Depth Measurements (m)**
Transect 1					
Habitat Type: Riffle Run Glide Pool					
Transect 2					
Habitat Type: Riffle Run Glide Pool					
Transect 3					
Habitat Type: Riffle Run Glide Pool					

**

Wetted Width	# Measurements
< 1 m	3
1 m to 4 m	5
>4 m	7

Photo Information

Roll Name (Number): _____

Photo #:_____ Azimuth_____ Direction (circle one): Upstream Downstream Panorama

Photo #._____ Azimuth_____ Direction (circle one): Upstream Downstream Panorama

Photo #:_____ Azimuth_____ Direction (circle one): Upstream Downstream Panorama

Horizontal Distance of Undercut Banks:

	Left Bank	Right Bank
Transect 1		
Transect 2		
Transect 3		

Other:

Photo #._____ Caption: _____

Photo #._____ Caption: _____

Photo #._____ Caption: _____

1999 Beneficial Use Reconnaissance Project Field Forms

Stream Name: _____ Site ID: 1999S Date (YY/MM/DD): 99

Longitudinal Habitat Distribution (meters)

Riffle	Run	Glide	Pool
Total	Total	Total	Total

Streambank Condition (percent)

Left Bank Facing Upstream				Right Bank Facing Upstream			
Covered Stable	Covered Unstable	Uncvred Stable	Uncvred Unstable	Covered Stable	Covered Unstable	Uncvred Stable	Uncvred Unstable

Habitat Assessment Summary Sheet

Prevalence (circle one)			
Riffle/Run		Glide/Pool	
1. Bottom Substrate - % fines			1. Pool Substrate Char.
2. Instream Cover			2. Instream Cover (fish)
3. Embeddedness (riffles)			3. Pool Variability
4. Velocity/Depth			4. Canopy Cover
5. Channel Shape			5. Channel Shape
6. Pool/Riffle Ratio			6. Channel Sinuosity
7. Width/Depth Ratio (wetted)			7. Width/Depth Ratio
8. Bank Vegetation Protection			8. Bank Vegetation Protection
9. Bank Stability			9. Bank Stability
10. Disruptive Pressures			10. Disruptive Pressures
11. Zone of Influence			11. Zone of Influence
Total Score			

Pool Quality Index

Pool Quality Parameter	Pool Number 1	2	3	4	
Max Pool Depth (m)					
Tail Out Depth (m)					
Pool Length (m)					
Max Pool Width (m)					
					Code Explanation
Residual Depth (m)					<0.15m = 0
					0.15m to 0.45m = 1
code					>0.45m = 2
Avg Substrate Size (mm)					<63.5mm = 0
					63.5 to 254mm = 1
code					>254mm = 2
Overhead Cover (%)					<10% = 0
					10% to 25% = 1
code					>25% = 2
Undercut Banks (%)					<25% = 0
					25% to 50% = 1
code					>50% = 2
Submerged Cover (%)					<10% = 0
					10% to 25% = 1
code					>25% = 2
Total Score					
				Ave Score	

APPENDIX III. MACROINVERTEBRATE LAB SUBMITTAL SHEET

1999 Beneficial Use Reconnaissance Project

Idaho Division of Environmental Quality

Macroinvertebrate Data Sheet

Billing Code: | | | | Fill in all shaded areas prior to sample submittal

Stream Name		Site ID:		Collection Date:	99
Twnshp:		Range:		Section:	
1/4s		County:			
Latitude:		Longitude:			
Location Relative to Lankmark:		Subsample No.	T01 + T02 + T03		
Elevation:		Collector (First Initial & Last Name):			
Sample Method:		Report Results To:			
Sample Area:		Flow Conditions:			
Collection Time(s):		Habitat Sampled:			
Sample Effort (Minutes)	2 Minute Minimum	Analysis Requested:	500		

Identifying Lab: ______________________ Date Into Lab: __________

Taxonomist: ______________________ Date Reported: __________

Sorter: ______________________ Total Grids: __________

Remarks: Grids Picked:

IDHW Log:

Taxon **Diptera**	Taxon Code	Total No.	ID Con	Taxon **Trichoptera**	Taxon Code	Total No.	ID Con

Taxon	Taxon Code	Total No.	ID Con
Plecoptera			
Coleoptera			
Gastropoda			
Turbellaria			

Taxon	Taxon Code	Total No.	ID Con
Ephemeroptera			
Hirundinea			
Crustacea			
Other			

APPENDIX IV. ELECTROFISHING FIELD FORM

Division of Environmental Quality Fish Data Sheet

Field Information - Shaded areas must be completed before submittal of sample

DEQ Project Code			-								-				-				

Name of Water Body				Site ID Nº:	
Location Description: permanent Landmarks					
Station or subsample Nº:	County:	Township	Range:	Section:	Quarter:
Elevation:	Collector(s) First (or initial) & Last Names(s):				Sample Method:
Collection date (YY/MM/DD)	Reach Length:			Avg. Reach Width:	
Field Taxonomist:	Temperature:			Conductivity:	

Identifying Lab Information:

Lab Name:	Date Into Lab:	Date Reported:
Taxonomist (First Initial & Last Name):		Remarks:

Taxa Vouchered:

Anomalies Noted:

Equipment Settings:

Species Stocked in last 5 years (note year)

Field Comments:

Stream Name: _____ Site ID Nº: _____ Date: ___/___/___

Fish Collection Data Form (reconnaissance)

reach length (m):	avg. reach width (m):	method: ☐ visual, ☐ snorkel, ☐ electrofish (☐AC ☐DC)
conductivity (μS/cm):	water clarity: turbid, clear, stained	effort(s):

species code*	species	total length (mm)	voucher (y/n)	total count	identification conf.**	anomalies ***	# of juveniles

Fish Collection Data Form Adapted from DEQ Protocol #6. * see 1998 training manual for updated codes** Fish confidence Codes: A (99.9%) - Must have fisheries taxonomist on collection crew or entire sample preserved and taxa work done by fisheries taxonomist (no visual estimate), B (99%) - Must have an experienced fisheries biologist on collection crew, or only part of sample preserved, C (90%) - Crew made up of individuals familiar with species, D (<90%) - No confidence or confidence unknown. *** Anomalies include parasites, deformities, frayed fins, etc.

Stream Name: _____ Site ID Nº: _____ Date: _____/_____/_____

APPENDIX V. BACTERIA FIELD CHECK SHEET

1999 Beneficial Use Reconnaissance Project

Idaho Division of Environmental Quality

Bacteria Check Sheet

Stream Name:		Site ID:		Collection Date:	99

HUC #:

1	Is Primary Contact Recreation a Designated or Existing Use	Yes	No	If Yes collect 1 sample *****
				if No collect 1 sample *******
2	Are upstream land uses affecting recreation use **	Yes	No	if Yes collect 1 sample *******
3	Other reasons ***	Yes	No	if Yes collect 1 sample *******

explain other reasons

collect 1		
collect 5		

** include agriculture, grazing, recreation, urban, cabins, septic

*** on 303d list for bacteria, etc.

***** if fecal exceeds 500/100ml, or if e-coli exceeds 406/100ml, collect 5 samples over 30 days

******* if fecal exceeds 800/100ml, or if e-coli exceeds 576/100ml, collect 5 samples over 30 days

Sample Results

sample #	date	time	location	Fecal results	E-coli results
sample #1					
sample #2					
sample #3					
sample #4					
sample #5					
sample #6					
			geometric mean		

* if sample #1 exceed standards, collect remaining 4 samples

other notes:

APPENDIX VI. ELECTROFISHING SAFETY PLAN

APPENDIX VI. ELECTROFISHING SAFETY PLAN

Purpose

The purpose is to ensure human safety during electrofishing operations by establishing Division of Environmental Quality competency requirements for electrofishing operations. This plan also provides guidelines for a standard operating procedure and the safe operation of electrofishing equipment.

Scope

The provisions of this plan apply to all IDEQ activities using electricity (produced by gasoline powered generator/alternators or batteries) to sample animals in aquatic habitats.

Policy

IDEQ recognizes the electrofishing operation as a hazardous activity for which skills and training is required. It is, therefore, IDEQ policy that all personnel serving as BURP (Beneficial Use Reconnaissance Project) coordinators demonstrate knowledge of the principles and techniques of electrofishing. BURP coordinators will be considered knowledgeable of the principles and techniques of electrofishing upon satisfactory completion of the US Fish and Wildlife Service, Principles and Techniques of Electrofishing course or equivalent training.

Responsibilities

A. The IDEQ Health and Safety Coordinator is responsible for maintaining a current listing of all IDEQ personnel who have attended electrofishing training.

B. The IDEQ Regional Administrators are responsible for ensuring compliance with the provisions of this plan.

C. BURP Coordinators are responsible for:

(1) Providing electrofishing crews with the proper equipment and ensuring that such equipment is fully functional at the beginning of the field season.

(2) Ensuring that the electrofishing crews have and utilize the proper safety equipment.

(3) Ensuring that all crew members are first aid and CPR certified

(4) Ensuring the availability of a well equipped, water-tight first aid kit.

(5) Discussing potential hazardous conditions encountered during electrofishing operations with crew members

(6) Ensuring that all crew members are trained in proper electrofishing techniques.

(7) Designating an electrofishing team leader.

D. Electrofishing Team Leader. Only individuals demonstrating knowledge of electrofishing techniques can serve as electrofishing team leaders. As the individuals in charge of electrofishing operations, the team leaders are responsible for following:

(1) Identifying hazardous field conditions associated with proposed electrofishing operations, determining measures to protect electrofishing team members, and appropriately briefing team members.

(2) Ensuring precautions are taken in the field to avoid harm to the public, domestic animals, or wildlife

(3) Ensuring that all electrofishing operations cease and all crew members go ashore in the event of a inclement weather.

(4) Ensuring that electrofishing operations include only those persons necessary to conduct a safe and efficient operation and those members being trained.

(5) Reviewing the electrofishing considerations checklist and ensuring the addition of specialized items to the checklist that pertain to their Regions or operation.

(6) Inspecting electofishing equipment during the field season to assure that it is properly functioning. If repairs are needed, this must be brought to the attention of the Regional BURP coordinator.

E. All crew members must know who their leader is and recognize his/her authority as final in operational decisions. Every crew member has the right to ask questions about any aspect of an electrofishing operation. A crew member has the right to decline participation in the operation if he/she feels unsafe working in the field conditions present. Crew members are responsible for reporting all potential work hazards, accidents, incidents, and job related illnesses/injuries to their regional BURP coordinator.

Training and Education

A. It is recommended that BURP Coordinators attend the US Fish and Wildlife Service, Principles and Techniques of Electrofishing course so that they have knowledge of the following:

(1) The basic principles of electricity and transmission of current in water.

(2) The basic concept and design guidelines for electrofishing equipment.

(3) Electrofishing equipment, the equipment's capabilities, limitations, and safety features.

(4) The safety precautions to employ while using electrofishing equipment.

B. All members of the electrofishing crew must have a current certification in cardiopulmonary resuscitation (CPR) and first aid. All crew members will be briefed in the following areas:

(1) Hazards involved in electrofishing.

(2) Safe operation of electrofishing equipment.

(3) Basic emergency procedures for drowning, unconsciousness, and electrical shock.

(4) Communication between electrofishing crew members while operating equipment.

Standard Safety Equipment

A. All persons using portable electrofishers will wear protective gear which will insulate the wearer from electrical shock, preferably chestwaders but rubber hip boots could suffice. All footwear will be equipped with non-slip soles.

B. Appropriate gloves will be worn and will be inspected for punctures before each use and will be replaced if damaged.

C. Polarized sunglasses will be worn when there is glare on the water.

Standard Operating Procedure

All persons must be aware of the hazards involved in using portable electrofishers in running waters, such a slippery surfaces, swift water currents, deep areas, and obstacles such a logs or similar objects.

(1) A minimum of three people must be present to conduct electrofishing operations.

(2) At all times during the electrofishing operation, the crew must communicate as to whether or not the unit is putting power into the water. If a crew member must reach into the water with their hands, it is their responsibility to inform the person operating the equipment so that they can stop the operation. Communication between crew members is essential to a safe operation.

(3) Netters will work beside or behind the individual with the electrofishing equipment to ensure the electrical field is well in front of both workers.

(4) Crew members should only perform one job at a time. A person should not be carrying the bucket of fish and netting at the same time.

(5) While walking in the stream, make sure that one foot is securely planted before stepping with the other foot. Do not cross one leg over the other, especially while walking in swift water.

(6) The individual operating the electrofishing unit should not turn the power on until all crew members are in position and have stable footing.

(7) Crew members will cease electrofishing operations during inclement weather; use discretion during rain.

(8) All safety equipment will be utilized.

(9) All operating manuals for electrofishing equipment must be available to the crew while in the field.

Portable Electrofisher Equipment Specifications and Operation. Only professionally produced electrofishing equipment should be used and the equipment should not be altered in any way.

(1) Electrodes.

(a) Electrode handles will be constructed of a nonconductive material and be long enough to avoid hand contact with the water.

(b) The positive electrode (anode) used with portable electrofishers will be equipped with a pressure switch that interrupts the electric current upon release.

(2) Portable Electrical Power Source.

(a) Batteries used as an electrical power source for backpack shockers will be of the gel type that will not leak when tipped or overturned.

(b) Backpacks will be equipped with a quick release belt (hip) and shoulder straps.

(3) Power Control.

(a) The operator will have a switch to the pulsator or power control unit so that the electricity can be turned off quickly in an emergency.

(b) All equipment purchased after October 1, 1985, must be equipped with a tilt switch that breaks the circuit if the operator falls.

Definitions

anode - The positive electrode.

cathode - The negative electrode.

deadman switch - A switch which requires constant pressure to supply electrical current to the circuit.

electrofishing - The use of electricity to provide a sufficient electrical stimulus in fish to permit easy capture by netting.

electrofishing team leader - The individual in charge of the electrofishing operation.

ground - A conducting connection, whether intentional or accidental, between an electric circuit or equipment and the earth or to some conducting body that serves in place of the earth.

netter - The individual who nets the captured fish during electrofishing operations.

APPENDIX VII. ELECTROFISHING TRAINING

APPENDIX VII. ELECTROFISHING TRAINING
Acknowledgment Form

Idaho Beneficial Use Reconnaissance Project
ACKNOWLEDGMENT OF ELECTROFISHING ORIENTATION

I have received instruction and orientation about electrofishing from the Idaho Division of Environmental Quality. As a result, I understand and accept the following principles:

1. Electrofishing (EF) is an inherently hazardous activity in which safety is the primary concern. The electrical energy used in EF is sufficient to cause electrocution. During operations, It is critical to avoid contact with the electrodes and surrounding water. The EF field is most intense near the electrodes, but can extend outward 10-20 feet.

2. A communication system must be known by all members of an EF crew. A minimum of three people are required for all EF operations. Crew members should only perform one job at a time (e.g. a person should not be carrying the bucket of fish and netting at the same time).

3. The individual operating the electrofishing unit should not turn the power on until all crew members are in position, have stable footing, and all members agree to begin.

4. An EF operation should proceed slowly and carefully; avoid fish-chasing and other sudden maneuvers. Operations should cease during inclement weather; use discretion during rain.

5. The main power switch must be turned off immediately if an emergency occurs.

6. Rubber knee boots are minimal foot protection, as are rubber gloves for the hands. Chest waders with felt soles are recommended. Ear protection is recommended for those working near the generator. Crews will be provided with the necessary safety equipment that is in proper working condition.

7. All members of the EF crew must be certified for CPR and first aid. A first aid kit must be within immediate reach during an EF operation.

8. Stunned fish should be removed from the EF field as soon as possible, and not subjected to continuous power by being held in the field. Using the anode as a dip net should be avoided is poor electrofishing technique and potentially injourus to fish.

9. Measures should be taken to avoid harm to the public, domestic animals, and wildlife. The public cannot participate in electrofishing operations.

10. All EF crew members must know who their leader is and recognize his/her authority as final in operational decisions. However, every crew member has the right to ask questions about any aspect of an EF operation. A crew member has the right to decline participation in an EF operation, without fear of employer recrimination, if he/she feels unsafe in doing such work.

_____ _____

Signature of Employee Date

APPENDIX VIII. ELECTROFISHING CHECKLIST

APPENDIX VIII. ELECTROFISHING CHECKLIST

Backpack Electrofisher Daily Safety Inspection

Date:_____ Stream: _____

Electrofishing Leader: _____ Crew ID: _____

Crew Members: _____

Manual present? Yes _____ No _____

GENERATOR/ALTERNATOR
(where applicable)

_____ 1. Electrical connections secure and protected
_____ 2. Mountings secure
_____ 3. Exhaust directed away from operator
_____ 4. Oil topped up
_____ 5. Gas topped up
_____ 6. Engine clean - no oil or gas leaks

BATTERY (where applicable)

_____ 1. Fully charged, get type cell
_____ 2. Terminals clean and tight

ELECTROFISHER

_____ 1. Controls and gauges operational
_____ 2. Adequate protection of wiring
_____ 3. Adequate connectors and interlocking
_____ 4. Audible tone generator working
_____ 5. "Kill switch" working
_____ 6. Mercury tilt switch working
_____ 7. Anode switch working
_____ 8. Wiring to anode in good condition
_____ 9. Anode in good condition, fastened securely
_____ 10. No screens or nets attached to anode
_____ 11. Cathode in good condition
_____ 12. Cathode clean, fastened securely
_____ 13. Backpack frame in good condition
_____ 14. Quick release buckle of backpack working

ANCILLARY EQUIPMENT

_____ 1. Dip net handle made of non-conductive material
_____ 2. First aid kit present
_____ 3. Regulation gas containers
_____ 4. Fish holding containers
_____ 5. Fish measuring board
_____ 6. Jars with formalin
_____ 7. Fish labels
_____ 8. Fish field forms
_____ 9. Formalin safety equipment

PERSONNEL/CREW MEMBERS

_____ 1. Each crew member briefed on unit operation
_____ 2. Three or more crew members present, all CPR certified
_____ 3. Each crew member wearing rubber gloves
_____ 4. Each crew member wearing waders or rubber boots
_____ 5. Safety precautions covered
_____ 6. Local arrangements covered (landowner, Fish & Game)

APPENDIX IX. VOUCHERING ADDENDUM IDEQ

APPENDIX IX. VOUCHERING ADDENDUM IDEQ PROTOCOL #6

Fish Vouchering Procedures

Vouchering Purpose

Vouchering of fish specimens is a quality assurance procedure at IDEQ and is a routine step in "good biological science". Vouchered specimens are used for taxonomic quality control, public education, staff training, research and evidence in beneficial use attainability, status and environmental investigations. To serve these purposes, enough specimens of each species from each site should be vouchered to document the range of size and individual characteristics of each species at a site. This documentation can normally be accomplished by collecting five or six specimens of each species from the site.

Vouchering fish specimens must comply with any applicable scientific collection regulations and restrictions. The IDEQ uses the Orma J. Smith Museum of Natural History, Albertson College of Idaho, Caldwell, ID as our depository for fish (and macroinvertebrate) voucher specimens. IDEQ fish collection permits need to specify the Orma J. Smith Museum as the depository for the vouchered material. A photocopy of the collection permit is also needed by the museum to document legal possession of vouchered materials.

Vouchering Procedures

Step 1: Place live specimens in 10% formalin solution as a fixing agent. Using live specimens allows the formalin solution to be ingested and respirated into the interior organs and tissues of the fish. Specimens over 300 mm (one foot) in maximum total length must have a small incision made in the abdomen and/or have formalin injected into the large muscles.

Step 2: Be sure all the specimens are totally covered with formalin.

Step 3: Completely fill out two IDEQ fish specimen labels with No. 2 pencil or alcohol/formalin proof pen such as the Sakura Micron Pigma. Let any ink used dry completely before placing in the sample container. Make an initial field identification of the specimens being vouchered. Place one label in with the vouchered fish. Tape the other to the outside of the sample container.

Step 4: Note on field data sheet which specimens or species are being vouchered.

Step 5: Send a legible copy of the field data sheets, a copy of the collection permit and the specimens to Don W. Zaroban (1410 N. Hilton Street, Boise, ID 83706, phone number: (208) 373-0260).

APPENDIX X. FORMALIN HEALTH AND SAFETY

APPENDIX X. FORMALIN HEALTH AND SAFETY

All field and laboratory activities will be performed in accordance with the Occupational Safety and Health Administrations requirements for a safe work place. It is the responsibility of the participants to establish and implement the appropriate health and safety procedures for the work being performed. All field staff are expected to review and understand the Material Safety Data Sheet and the Chemical Fact Sheet for chemicals of concern provided by field staff supervisors. Field staff are instructed to immediately report to their supervisor the development of any adverse signs or symptoms that they suspect are attributable to chemical exposure.

The environmental samples scheduled to be collected during this project will be obtained from surface water bodies located in natural settings. Samples to be collected include fish specimens and aquatic macroinvertebrates. The sample stations and samples to be collected are not considered to be hazardous; however, sample preservation materials include formalin (formaldehyde) which requires prudent safety precautions by those collecting samples and those coming into contact with or disposing of samples collected during this project.

Hazardous Materials (Formaldehyde)

Commercial grade formalin contains 37 to 55 percent formaldehyde. The use of formaldehyde and its derivatives are regulated under 29 CFR 1910.1048. Formaldehyde is a suspected human carcinogen. Formaldehyde is highly flammable and is incompatible with strong oxidizers, strong alkalies, acids; phenols; and urea.

Formaldehyde Exposure Limits

There may be no safe level of exposure to a carcinogen so all contact with formalin should be reduced to the lowest possible level. The odor threshold of 0.83 parts per million (ppm) for formaldehyde serves only as a warning of exposure. The permissible exposure limit (PEL) for formaldehyde is 0.75 ppm averaged over an 8 hour work shift. The time-weighted average (TWA) for airborne concentrations of formaldehyde (STEL) is 2 ppm. The American Conference of Governmental Industrial Hygienist recommend airborne exposure limit to formaldehyde is not to exceed 0.3 ppm averaged over an 8 hour work period.

Respirators shall be used when 1) installing feasible engineering and work practice controls, 2) engineering and work practice controls are not feasible, and 3) engineering and work practice controls are not sufficient to reduce exposure to or below the Permissible Exposure Limit. Respirator use should be limited to an MSHA/NIOSH approved supplied air respirator with a full face piece operated in the positive mode or with a full face piece, hood, or helmet operated in the continuous flow mode. An MSHA/NIOSH approved self contained breathing apparatus with a full face piece operated in pressure demand or other positive mode is also recommended.

Formaldehyde exposure occurs through inhalation and absorption. Exposure irritates the eyes, nose, and throat and can cause skin and lung allergies. Higher levels can cause throat spasms and

a build up of fluid in the lungs, cause for a medical emergency. Contact can cause severe eye and skin burns, leading to permanent damage. These may appear hours after exposure, even if no pain is felt.

Formaldehyde First Aid

If formaldehyde gets into the eyes, remove any contact lenses at once and irrigate immediately with deionized water, distilled water or saline solution. If formaldehyde contacts exposed skin flush with water promptly. If a person breathes in large amounts of this chemical, move the exposed person to fresh air at once and perform artificial respiration if needed. When formaldehyde has been swallowed, get medical attention. Give large quantities of water and induce vomiting. Do not make an unconscious person vomit.

Formaldehyde Fire and Explosion Hazard

Mixtures of air and free formaldehyde gas are highly flammable. Formalin is a combustible liquid, and presents a moderate fire and explosion hazard. Use a dry chemical, carbon dioxide, water spray, or "alcohol" form to extinguish formalin fires. Store formalin solutions in insulated, closed containers in a cool, dry, well ventilated area separate from oxidizing agents and alkaline materials. Protect formalin containers from physical damage.

Formalin Spill Procedures

In case of a spill or leak, eliminate all sources of ignition, provide adequate ventilation, notify supervisor and evacuate all nonessential personnel. Neutralize spilled formalin with aqueous ammonia or mix with sodium sulfite. Wash residues with dilute ammonia to eliminate vapor. Prevent runoff from entering streams, surface waters, waterways, watersheds, and sewers.

Formalin Work Area Controls

Work area locations at stream sampling stations will be selected to ensure adequate ventilation when sample container lids are removed. Work area locations will be located downwind from field crew activities and will be isolated from field crew traffic. A single field crew member will be designated and authorized to secure the formaldehyde work area at sampling stations. This crew member will ensure proper handling of sample containers and fish specimens and will be responsible for establishing proper precautions for minimizing field crew exposure to formaldehyde at sampling stations.

Formalin Work Area Practices

Formalin (formaldehyde) is being used in this protocol for the purpose of asphyxiation and preservation of fish specimens. Pre-labeled and pre-preserved plastic sample containers will be delivered to the field crew secured in large ice chests. Field crews will transport the containers in the coolers to the field sample stations. Fish specimens will be collected by hand and place into the sample containers. Container lids will be removed immediately prior to and closed immediately after fish specimens and specimen labels are placed into the sample container. Specimens will be placed into the sample container and minimize the amount of time the sample preservative is not

contained. The sample container will be placed into a large plastic bag and secured in an ice cooler until delivered to the laboratory for analysis.

Formalin Personal Protection

Field crew members within the designated formalin work area at sample stations will wear a full face shield, impervious nitrile, butyl rubber, or viton gloves, boots and aprons, etc. to prevent excessive or prolonged skin contact. Contact lenses will not be worn within the designated formalin work area. No eating, drinking, or smoking will be allowed in the designated formalin work area.

Wash thoroughly after using formalin. Avoid transferring formalin from hands to mouth while eating, drinking, or smoking. Avoid direct contact with formalin. Remove contaminated clothing and launder before wearing. Contaminated work clothing should not be taken home. Contaminated work clothing should be laundered by individuals who have been informed of the hazards of exposure to formalin.

APPENDIX XI. MATERIAL SAFETY DATA SHEETS

001 03/30/99 ETHANOL RED BAND III 190 PROOF

Section 1. Chemical Product

Product Name:	Ethanol Red Band III 190 proof
MSDS#	CM0287
Date Issued:	3/29/99
Supersedes:	New
Issued By:	000099
Synonym	Not available.
Trade Names:	Not available.
Material Uses	Not available.

Section 2. Composition and Information on Ingredients

Name	CAS #	% by Weight	Exposure Limits
Ethanol	64-17-5	90-95	TWA: 1880 (mg/m3) from ACGIH (TLV) TWA: 1000 (ppm) from ACGIH (TLV) TWA: 1900 (mg/m3) from OSHA TWA: 1000 (ppm) from OSHA
Water	7732-18-5	5	Not available.
Methyl alcohol	67-56-1	3-4	TWA: 262 STEL: 328 (mg/m3) from ACGIH (TLV) TWA: 200 STEL: 250 (ppm) from ACGIH (TLV) SKIN TWA: 260 STEL: 328 (mg/m3) from OSHA TWA: 200 STEL: 328 (ppm) from OSHA
Ethyl acetate	141-78-6	0-2	TWA: 1440 (mg/m3) from ACGIH (TLV) TWA: 400 (ppm) from ACGIH (TLV) TWA: 1400 (mg/m3) from OSHA TWA: 400 (ppm) from OSHA
Methyl isobutyl ketone	108-10-1	0-2	TWA: 205 STEL: 307 (mg/m3) from ACGIH (TLV) TWA: 50 STEL: 75 CEIL: 125 (ppm) from ACGIH (TLV) TWA: 410 STEL: 307 CEIL: 510 (mg/m3) from OSHA TWA: 100 STEL: 75 (ppm) from OSHA
Light aliphatic solvent naphtha (petroleum)	64742-89-8	0-2	Not available.

Ingredients not precisely identified are proprietary or nonhazardous under Federal Hazard Communication Standard (29 CFR 1910.1200).

Section 3. Hazards Identification

Physical State and Appearance
Liquid.

Emergency Overview
WARNING!
Keep away from heat, sparks and flame. Avoid contact with eyes Avoid breathing vapors or spray mists. Avoid contact with skin and clothing. Keep container closed. Use only with adequate ventilation. Wash

thoroughly after handling.

Routes of Entry
Dermal contact. Eye contact. Inhalation. Ingestion.
Potential Acute Health Effects
Eyes
Hazardous in case of eye contact (irritant).
Skin
Sensitization of the product: Not available.
Very hazardous in case of skin contact (irritant).
Slightly hazardous in case of skin contact (permeator). Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.
Inhalation
Slightly hazardous in case of inhalation.
Ingestion
Slightly hazardous in case of ingestion.
Potential Chronic Health Effects
CARCINOGENIC EFFECTS: Classified A4 (Not classifiable for human or animal.) by ACGIH (Ethanol). Classified A4 (Not classifiable for human or animal.) by ACGIH (Ethyl acetate).
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
Medical Conditions Aggravated by Overexposure:
Repeated or prolonged exposure is not known to aggravate medical condition.
Overexposure /Signs/Symptoms
Not available.
See Toxicological Information (Section 11)

Section 4. First Aid Measures
Eye Contact
Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.
Skin Contact
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cold water may be used. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.
Hazardous Skin Contact
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.
Inhalation
Allow the victim to rest in a well ventilated area. Seek immediate medical attention.
Hazardous Inhalation
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek medical attention.
Ingestion
Do not induce vomiting. Examine the lips and mouth to

ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.
Hazardous Ingestion
Not available.
Notes to Physician
Not available.

Section 5. Fire Fighting Measures
Flammability of the Product
Flammable.
Auto-ignition Temperature
The lowest known value is 363 deg C (685.4 deg F) (Ethanol).
Flash Points
The lowest known value is CLOSED CUP: -4.4 deg C (24.1 deg F). OPEN CUP: -4 deg C (24.8 deg F). (Cleveland). (Ethyl acetate)
Flammable Limits
The greatest known range is LOWER: 6% UPPER: 36.5% (Methyl alcohol)
Products of Combustion
These products are carbon oxides (CO, CO2).
Fire Hazards in Presence of Various Substances
Flammable in presence of open flames and sparks, of heat, of combustible materials.
Slightly flammable to flammable in presence of oxidizing materials.
Explosion Hazards in Presence of Various Substances
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.
Fire Fighting Media and Instructions
Flammable liquid, soluble or dispersed in water.
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use alcohol foam, water spray or fog.
Protective Clothing (Fire)
Be sure to use an approved/certified respirator or equivalent.
Special Remarks on Fire Hazards
Containers should be grounded. (Ethanol)
Special Remarks on Explosion Hazards
Not available.

Section 6. Accidental Release Measures
Small Spill
Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container.
Large Spill
Flammable liquid.
Keep away from heat Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7. Handling and Storage
Handling

Keep away from heat Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/spray. Wear suitable protective clothing If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes Keep away from incompatibles such as oxidizing agents.

Storage

No specific storage is required. Use shelves or cabinets sturdy enough to bear the weight of the chemicals. Be sure that it is not necessary to strain to reach materials, and that shelves are not overloaded.

Section 8. Exposure Controls/Personal Protection

Engineering Controls

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection

Eyes

Splash goggles.

Body

Lab coat.

Respiratory

Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.

Hands

Gloves.

Feet

Not applicable.

Personal Protection in Case of a Large Spill

Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Chemical Name or Product Name	Exposure Limits
Ethanol	TWA: 1880 (mg/m3) from ACGIH (TLV) TWA: 1000 (ppm) from ACGIH (TLV) TWA: 1900 (mg/m3) from OSHA TWA: 1000 (ppm) from OSHA
Methanol	TWA: 262 STEL: 328 (mg/m3) from ACGIH (TLV) TWA: 200 STEL: 250 (ppm) from ACGIH (TLV) SKIN TWA: 260 STEL: 328 (mg/m3) from OSHA TWA: 200 STEL: 328 (ppm) from OSHA
Ethyl acetate	TWA: 1440 (mg/m3) from ACGIH (TLV) TWA: 400 (ppm) from ACGIH (TLV) TWA: 1400 (mg/m3) from OSHA TWA: 400 (ppm) from OSHA
Methyl isobutyl ketone	TWA: 205 STEL: 307 (mg/m3) from ACGIH (TLV) TWA: 50 STEL: 75 CEIL: 125 (ppm) from ACGIH (TLV) TWA: 410 STEL: 307 CEIL: 510 (mg/m3) from OSHA TWA: 100 STEL: 75 (ppm) from OSHA
Light aliphatic solvent naphtha (petroleum)	Not available.

Consult local authorities for acceptable exposure limits.

Section 9. Physical and Chemical Properties
Physical State and
Appearance
Liquid.
Boiling/Condensation Point
The lowest known value is 64.7 deg C (148.5 deg F) (Methyl alcohol). Weighted average: 79.34 deg C (174.8 deg F)
Melting/Freezing Point
May start to solidify at 0 deg C (32 deg F) based on data for: Water. Weighted average: -107.42 deg C (-161.4 deg F)
Color
Not available.
Specific Gravity
Weighted average: 0.8 (Water = 1)
Vapor Pressure
The highest known value is 97.68 mm of Hg (at 20 deg C) (Methyl alcohol). Weighted average: 42.15 mm of Hg (at 20 deg C)
Vapor Density
The highest known value is 3.45 (Air = 1) (Methyl isobutyl ketone). Weighted average: 1.62 (Air = 1)
Volatility
Odor Threshold
The highest known value is 180 ppm (Ethanol) Weighted average: 175.8 ppm
Evaporation Rate
The highest known value is 3.3 (Ethanol) Weighted average: 3.28compared to Butyl acetate.
VOC
Viscosity
Not available.
Solubility
Easily soluble in cold water, hot water, methanol, diethyl ether.
pH (1% Soln/Water)
Neutral.
Odor
Not available.
Taste
Not available.
Physical Chemical Comments
Not available.

Section 10. Stability and Reactivity
Stability and Reactivity
The product is stable.
Conditions of Instability
Not available.
Incompatibility with Various Substances
Reactive with oxidizing agents.
Non-reactive with acids, alkalis.
Hazardous Decomposition Products
Not available.
Hazardous Polymerization
Not available.

Section 11. Toxicological Information
Toxicity to Animals
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE.
Acute oral toxicity (LD50): 2080 mg/kg (Rat). (Methyl isobutyl ketone).
Acute dermal toxicity (LD50): 15800 mg/kg (Rabbit.). (Methyl alcohol).

Acute toxicity of the vapor (LC50): 8000 ppm 4 hour(s) (Rat.). (Ethanol).
Chronic Effects on Humans
CARCINOGENIC EFFECTS: Classified A4 (Not classifiable for human or animal.) by ACGIH (Ethanol). Classified A4 (Not classifiable for human or animal.) by ACGIH (Ethyl acetate).
DEVELOPMENTAL TOXICITY: PROVEN (Ethanol)
The substance is toxic to blood, the nervous system, the reproductive system, liver, upper respiratory tract, skin, eyes, respiratory tract, gastrointestinal tract, kidneys.
Other Toxic Effects on Humans
Very hazardous in case of skin contact (irritant).
Slightly hazardous in case of skin contact (permeator), of ingestion, of inhalation.
Special Remarks on Toxicity to Animals
Not available.
Special Remarks on Chronic Effects on Humans
0040 Passes through the placental barrier.
May be fatal or cause blindness if swallowed. (Methyl alcohol)
Special Remarks on Other Toxic Effects on Humans
Moderately toxic and narcotic in high concentrations.
Experimentally tumorigen. (Ethanol)

Section 12. Ecological Information
Ecotoxicity
Not available.
BOD5 and COD
Not available.
Biodegradable/OECD
Not available.
Mobility
Not available.
Toxicity of the Products of Biodegradation
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.
The products of degradation are less toxic than the product itself.
Special Remarks on the Products of Biodegradation
Not available.

Section 13. Disposal Considerations
Waste Information
Not available.
Waste Stream
Not available.
Consult an expert on disposal of waste and materials used in spill cleanup and ensure conformity to all federal, state and local disposal regulations. Regulatory requirements are subject to change and may differ from one location to another; the generator of the waste is responsible for proper waste disposal.

Section 14. Transport Information
DOT Classification
Class 3: Flammable liquid.
Ethanol, Solution
UN1170
II

Marine Pollutant
Not available.
Hazardous Substances Reportable Quantity (Kg)
Not available.

Special Provisions for Transport
Not available.

Section 15. Regulatory Information
U.S. Federal Regulations
SARA 302/304 emergency planning and notification: No products were found.

CERCLA: Hazardous substances: Methyl alcohol: 5000 lbs. (2268 kg); Ethyl acetate: 5000 lbs. (2268 kg); Methyl isobutyl ketone: 5000 lbs. (2268 kg);

SARA 313 toxic chemical notification and release reporting: Methyl alcohol: 1%; Methyl isobutyl ketone: 1%

TSCA 5(e) substance consent order: Ethyl acetate; Methyl isobutyl ketone
TSCA 8(a) PAIR: Methyl isobutyl ketone
TSCA 8(a) IUR: Ethyl acetate; Methyl isobutyl ketone
TSCA 8(b) inventory: Ethanol; Water; Methyl alcohol; Ethyl acetate; Methyl isobutyl ketone; Light aliphatic solvent naphtha (petroleum)
TSCA 12(b) one time export: Ethyl acetate; Methyl isobutyl ketone

SARA 311/312 MSDS distribution - chemical inventory - hazard identification: Ethanol: fire, immediate health hazard, delayed health hazard; Methyl alcohol: fire, immediate health hazard, delayed health hazard; Ethyl acetate: fire, immediate health hazard; Methyl isobutyl ketone: fire, reactive, immediate health hazard; Light aliphatic solvent naphtha (petroleum): fire, immediate health hazard

State Regulations
Rhode Island RTK hazardous substances: Ethanol; Methyl alcohol; Ethyl acetate; Methyl isobutyl ketone
Pennsylvania RTK: Ethanol; Methyl alcohol: (environmental hazard); Ethyl acetate: (environmental hazard); Methyl isobutyl ketone: (environmental hazard)
Florida: Ethanol; Methyl alcohol; Ethyl acetate; Methyl isobutyl ketone
Minnesota: Ethanol; Methyl alcohol; Ethyl acetate; Methyl isobutyl ketone
Massachusetts RTK: Ethanol; Methyl alcohol; Ethyl acetate; Methyl isobutyl ketone
New Jersey: Ethanol; Methyl alcohol; Ethyl acetate; Methyl isobutyl ketone
New Jersey spill list: Ethanol; Methyl alcohol; Ethyl acetate; Methyl isobutyl ketone
California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: Ethanol

Section 16. Other Information
National Fire Protection Association (U.S.A.)

Health	1
Flammability	3
Reactivity	0
Specific Hazard	

Other Special Considerations
Not available.

This mixture has not been tested as a whole, the data presented is based on the properties of the individual components.

---------- NOTICE ----------

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IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE,

WITH RESPECT TO THE PRODUCT OR INFORMATION PROVIDED HEREIN, AND SHALL UNDER

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* * * E N D O F M S D S * * *

MSDS Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

MALLINCKRODT

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 202-483-7616

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

FORMALDEHYDE SOLUTION, BUFFERED 10%

1. Product Identification

Synonyms: Formaldehyde solution, buffered, 10% (v/v) in aqueous phosphate buffer
CAS No: Not applicable to mixtures.
Molecular Weight: Not applicable to mixtures.
Chemical Formula: HCHO and CH_3OH in water.
Product Codes: H121

2. Composition/Information on Ingredients

Ingredient	CAS No.	Percent	Hazardous
Methyl Alcohol	67-56-1	1 - 1.5%	Yes
Formaldehyde	50-00-0	4%	Yes
Water	7732-18-5	~ 95%	No

3. Hazards Identification

Emergency Overview

DANGER! MAY BE FATAL IF SWALLOWED. HARMFUL IF INHALED OR ABSORBED THROUGH SKIN. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. STRONG SENSITIZER. MAY CAUSE BLINDNESS. COMBUSTIBLE LIQUID AND VAPOR. SUSPECT CANCER HAZARD. CONTAINS FORMALDEHYDE WHICH MAY CAUSE CANCER. Risk of cancer depends upon duration and level of exposure.

Potential Health Effects

The perception of formaldehyde by odor and eye irritation becomes less sensitive with time as one adapts to formaldehyde. This can lead to overexposure if a worker is relying on formaldehyde's warning properties to alert him or her to the potential for exposure.

Inhalation:

May cause sore throat, coughing, and shortness of breath. Causes irritation and sensitization of the respiratory tract. Concentrations of 25 to 30 ppm cause severe respiratory tract injury leading to pulmonary edema and pneumonitis. May be fatal in high concentrations.

Ingestion:

Can cause severe abdominal pain, violent vomiting, headache, and diarrhea. Larger doses may produce decreased body temperature, pain in the digestive tract, shallow respiration, weak irregular pulse,

unconsciousness and death. Methanol component affects the optic nerve and may cause blindness.

Skin Contact:

Toxic. May cause irritation to skin with redness, pain, and possibly burns. Skin absorption may occur with symptoms paralleling those from ingestion. Formaldehyde is a severe skin irritant and sensitizer. Contact causes white discoloration, smarting, cracking and scaling.

Eye Contact:

Vapors cause irritation to the eyes with redness, pain, and blurred vision. Higher concentrations or splashes may cause irreversible eye damage.

Chronic Exposure:

Frequent or prolonged exposure to formaldehyde may cause hypersensitivity leading to contact dermatitis. Repeated or prolonged skin contact with formaldehyde may cause an allergic reaction in some people. Vision impairment and enlargement of liver may occur from methanol component. Formaldehyde is a suspected carcinogen (positive animal inhalation studies).

Aggravation of Pre-existing Conditions:

Persons with pre-existing skin disorders or eye problems, or impaired liver, kidney or respiratory function may be more susceptible to the effects of the substance. Previously exposed persons may have an allergic reaction to future exposures.

4. First Aid Measures

Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

Ingestion:

If swallowed and the victim is conscious, dilute, inactivate, or absorb the ingested formaldehyde by giving milk, activated charcoal, or water. Any organic material will inactivate formaldehyde. Keep affected person warm and at rest. Get medical attention immediately. If vomiting occurs, keep head lower than hips.

Skin Contact:

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

Note to Physician:

Monitor arterial blood gases and methanol levels after significant ingestion. Hemodyalysis may be effective in formaldehyde removal. Use formic acid in urine and formaldehyde in blood or expired air as diagnostic tests.

5. Fire Fighting Measures

Fire:

Flash point: 85°C (185°F) CC
Combustible liquid and vapor! Gas vaporizes from solution and is flammable in air.

Explosion:

Above the flash point, explosive vapor-air mixtures may be formed. Containers may explode when involved in a fire.

Fire Extinguishing Media:

Water spray, dry chemical, alcohol foam, or carbon dioxide.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Water spray may be used to keep fire exposed containers cool. Use water spray to blanket fire, cool fire exposed containers, and to flush non-ignited spills or vapors away from fire.

6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Store in a tightly closed container. Protect against physical damage. Outside or detached storage is preferred. Inside storage should be in a standard flammable liquids storage room or cabinet. Separate from oxidizing materials. Storage and use areas should be No Smoking areas. Wear special protective equipment (Sec. 8) for maintenance break-in or where exposures may exceed established exposure levels. Wash hands, face, forearms and neck when exiting restricted areas. Shower, dispose of outer clothing, change to clean garments at the end of the day. Avoid cross-contamination of street clothes. Wash hands before eating and do not eat, drink, or smoke in workplace. Protect from freezing. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

-OSHA Permissible Exposure Limit (PEL):
0.75 ppm (TWA), 2 ppm (STEL), 0.5 ppm (TWA) action level for formaldehyde
200 ppm (TWA) for methanol
-ACGIH Threshold Limit Value (TLV):
0.3 ppm Ceiling formaldehyde, A2 Suspected Human Carcinogen
200 ppm (TWA) 250 ppm (STEL) skin for methanol

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, "Industrial Ventilation, A Manual of Recommended Practices", most recent edition, for details.

Personal Respirator (NIOSH Approved)

If the exposure limit is exceeded, a full facepiece respirator with a formaldehyde cartridge may be worn up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air purifying respirators do not protect workers in oxygen-deficient atmospheres. Irritation also provides warning. For Methanol: If the exposure limit is exceeded, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus.

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

Other Control Measures:

See OSHA Standard for more information on personal protective equipment, engineering and work practice controls, medical surveillance, record keeping, and reporting requirements. (29 CFR 1910.1048)

9. Physical and Chemical Properties

Appearance:
Clear, colorless solution.
Odor:
Slight pungent odor.
Solubility:
Soluble in water.
Specific Gravity:
~1.0
pH:
No information found.
% Volatiles by volume @ 21°C (70°F):
100

Boiling Point:
~ 100°C (~ 212°F)
Melting Point:
~ 0°C (~ 32°F)
Vapor Density (Air=1):
Essentially the same as water.
Vapor Pressure (mm Hg):
Essentially the same as water.
Evaporation Rate (BuAc=1):
Essentially the same as water.

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
May form carbon dioxide, carbon monoxide, and formaldehyde when heated to decomposition.
Hazardous Polymerization:
Will not occur.
Incompatabilities:
Incompatible with oxidizing agents and alkalis. Reacts explosively with nitrogen dioxide at ~180°C (356°F). Reacts violently with perchloric acid, perchloric acid-aniline mixtures, and nitromethane. Reaction with hydrochloric acid may form bis-chloromethyl ether, an OSHA regulated carcinogen.
Conditions to Avoid:
Heat, flames, ignition sources and incompatibles.

11. Toxicological Information

Formaldehyde: Oral rat LD50: 100 mg/kg; skin rabbit LD50: 270 uL/kg, Irritation data: eye, rabbit, 750ug Severe; inhalation rat LC50: 203 mg/m^3; investigated as a tumorigen, mutagen, reproductive effector; Cancer Status: an OSHA regulated carcinogen. Methanol: oral rat LD50: 5628 mg/kg; inhalation rat LC50: 64000 ppm/4H; skin rabbit LD50: 15800 mg/kg; investigated as a tumorigen, mutagen, reproductive effector.

Cancer Lists

	—NTP Carcinogen—		
Ingredient	Known	Anticipated	IARC Category
Methyl Alcohol (67-56-1)	No	No	None
Formaldehyde (50-00-0)	No	Yes	2A
Water (7732-18-5)	No	No	None

12. Ecological Information

Environmental Fate:
The following statements refer to the environmental fate of formaldehyde. When released into the soil, this material is expected to leach into groundwater. When released into water, this material is expected to readily biodegrade. When released into water, this material is not expected to evaporate significantly. This material is not expected to significantly bioaccumulate. When released into the air, this material is expected to be readily degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to be readily degraded by photolysis. When released into the air, this material is expected to be readily removed from the atmosphere by dry and wet deposition. When released into the air, this material is expected to have a half-life of less than 1 day. The following statements refer to the environmental fate of methanol. When released into the soil, this material is expected to readily biodegrade. When released into the

soil, this material is expected to leach into groundwater. When released into the soil, this material is expected to quickly evaporate. When released into water, this material is expected to readily biodegrade. When released into the water, this material is expected to have a half-life between 1 and 10 days. When released into the air, this material is expected to exist in the aerosol phase with a short half-life. When released into the air, this material is expected to be readily degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to be readily removed from the atmosphere by wet deposition. When released into air, this material is expected to have a half-life between 10 and 30 days.

Environmental Toxicity:

The following toxicity information is for the formaldehyde portion. This material is expected to be slightly toxic to aquatic life. The LC50/96-hour values for fish are between 10 and 100 mg/l. The methanol portion is expected to be slightly toxic to aquatic life. The LC50/96-hour values for fish are between 10 and 100 mg/l.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations.

Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Not regulated.

15. Regulatory Information

Chemical Inventory Status

						—Canada—		
Ingredient	TSCA	EC	Japan	Australia	Korea	DSL	NDSL	Phil.
Methyl Alcohol (67-56-1)	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Formaldehyde (50-00-0)	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Water (7732-18-5)	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes

Federal, State & International Regulations

	—SARA 302—		——SARA 313——			-RCRA-	-TSCA-
Ingredient	RQ	TPQ	List	Chemical Catg.	CERCLA	261.33	8(d)
Methyl Alcohol (67-56-1)	No	No	Yes	No	5000	U154	No
Formaldehyde (50-00-0)	100	500	Yes	No	100	U122	No
Water (7732-18-5)	No	No	No	No	No	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No

SARA 311/312: Acute: Yes Chronic: Yes Fire: Yes Pressure: No Reactivity: No (Mixture / Liquid)

Warning:

THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

Australian Hazchem Code: 2T Australian Poison Schedule: No information found.

WHMIS: This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings:

Health: 3 Flammability: 2 Reactivity: 0

Label Hazard Warning:

DANGER! MAY BE FATAL IF SWALLOWED. HARMFUL IF INHALED OR ABSORBED THROUGH SKIN. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. STRONG SENSITIZER. MAY CAUSE BLINDNESS. COMBUSTIBLE LIQUID AND VAPOR. SUSPECT CANCER HAZARD. CONTAINS FORMALDEHYDE WHICH MAY CAUSE CANCER. Risk of cancer depends upon duration and level of exposure.

Label Precautions:

Keep away from heat, sparks and flame.
Do not breathe vapor.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Do not get in eyes, on skin, or on clothing.
Physical and health hazard information is available from employer and from material safety data sheets.

Label First Aid:

In all cases call a physician. If swallowed and the victim is conscious, dilute, inactivate, or absorb the ingested formaldehyde by giving milk, activated charcoal, or water. Any organic material will inactivate formaldehyde. Keep affected person warm and at rest. If vomiting occurs, keep head lower than hips. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes.

Product Use:

Laboratory Reagent.

Revision Information:

MSDS Section(s) changed since last revision of document include: 3, 4, 16.

Disclaimer:

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